JPRS-UHR-84-009

11 May 1984

USSR Report

HUMAN RESOURCES

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LABOR

FARM LABOR OFFICIAL CITES MODEL KOLKHOZ OPERATION

Moscow EKONOMICHESKAYA GAZETA in Russion No 48, Nov 83 p 16

[Article by R. Bogdan-Blakitnyi, deputy director Main Administration for Labor and Social Problems, USSR Ministry of Agriculture, "Production Grows - Pay Increases"]

[Text] At one of the commission meetings of the Presidium of the USSR Council of Ministers regarding questions of the agro-industrial complex, the experiment of the Kirov Belozerskii kolkhoz, in the Kherson Oblast, was discussed from the standpoint of material stimulation to production. The commission approved this experiment and recommended its wide dissemination. The forms of labor organization and how incentives act in this economy are related in the material published below.

After conducting a thorough intra-economic specialization, three production areas were established in the kolkhoz. The first one is involved in grain production. The second, in fodder cultivation, stock-piling and storage; all animal husbandry is concentrated here. The third production area deals with vegetable, fruit and grape cultivation.

Service subdivisions are centralized in the kolkhoz: garage, workshop, subdivisions for the mechanization of labor-intensive processes in animal husbandry and for land reclamation work. The kolkhoz accomplishes technical repairs, construction, conveying of mineral fertilizers and herbicides, as well as mixed fodder by means of its own forces.

How Labor Is Organized

The basic form of labor organization in agricultural production is the brigade. For vegetable growing, teams are organized within the brigade structure. Each subdivision has the necessary means of production and a permanent staff of kolkhoz members. Every 42 productive individuals are converted into an intra-economic team headed by specialists with higher or secondary special education.

Thanks to the rational organization of production, the introduction of scientific achievements and advanced economic experience have yielded high field crop and livestock productivity. It suffices to say that if, in the 8th five-year plan, the average amount of grain obtained per hectare was 29.5 quintals, it was

41 quintals in the 10th five-year plan and 63 quintals under irrigation. Almost 600 quintals of vegetables are obtained, which is far higher than the average regional index. A very great root plant fodder harvest is obtained here, as well as silage corn and lucerne. The average milk yield from cows reaches 4.333 kg. and the animals attain a weight of 447 kg. Calculating for 100 hectares of economically significant land, 1,170 quintals of milk and 135 quintals of meat are produced, while in the rayon the corresponding figures are 502 and 87 quintals respectively.

In the past year, the kolkhoz, on an area of 1,900 hectares, obtained 42.1 quintals of grain per hectare, including 45 quintals of winter wheat and, under irrigation, 65.3 quintals. Sunflowers yielded 24.5, lucerne in hay 140 quintals per hectare. A good harvest for all crops was grown this year.

High production indices were, in many respects, secured as a result of effective utilization of irrigated land. In the structure of areas under crops, it comprises 29 percent and the kolkhoz obtains about 70 percent of its plant products from it. Each hectare of irrigated land yields the kolkhoz 113 quintals of fodder units, while dry farming yields 42 quintals.

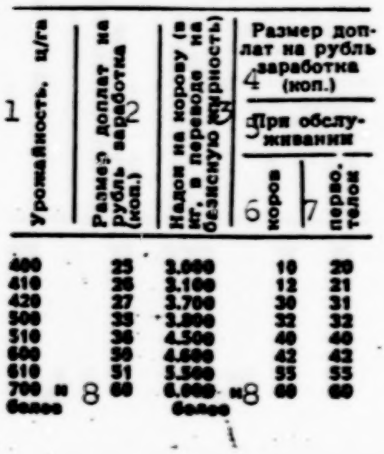
The growth of field crop and livestock productivity has been assisted by the application in the kolkhoz of the intra-economic team, the rational organization of labor and effective measures for material and moral interest on the part of the kolkhoz members in the end results of their labor. The salary in the economy, based on the minimal scale tariff rate, is 70 rubles per month. In the course of the year, until the products of the kolkhoz members' labor are obtained, those members occupied with plant growing are paid according to the volume of work fulfillment, while those occupied with animal husbandry are paid according to the valuation of products obtained, taking into account their quality, on the basis of 125 percent of the tariff fund and the yearly production norm.

The conditions determined for the payment of supplementary remuneration are worked out in the economy with such a calculation in order that they may be as simple as possible and stimulate the increase of agricultural crop productivity and the growth of livestock productivity.

The Scale of Crop Productivity and Salary

In the economy, scales of crop productivity (and livestock productivity) and wages have been worked out according to supplementary remuneration. Moreover, wage rates increase progressively in proportion to the growth of crop and livestock productivity. These scales of productivity and progressively increasing wages for output are stable for the five-year plan.

As an example, we give below supplementary payment scales used in the kolkhoz subject to the yield of vegetables and the productivity of a milk herd.



Key:
1. Crop productivity, quintals/hectare
2. Amount of supplementary pay for each ruble earned (kopeks)
3. Milk yield per cow (in kg., translated into basic fat)
4. Amount of supplementary pay for each ruble earned (kopeks)
5. For servicing
6. cows
7. First-born calves
8. and more

The indices of agricultural productivity and the rates of supplementary pay once in each five-year plan are revised in proportion to the perfecting of production technology, the introduction of new varieties and changes in other conditions of production. For example, during the years of the tenth five-year plan, kolkhoz members occupied with vegetable cultivation received an additional 35 kopeks for each ruble of basic salary on a harvest of 400 quintals, while now, as is evident from the scale, such a supplement is added for a vegetable yield of 500 quintals. A milkmaid formerly received an additional 40 kopeks for each ruble earned on a milk yield of 4,000 kg. per cow per year, while now this supplementary amount is added for a milk yield of 4,500 kg. per cow.

Kolkhoz members who, without valid cause, do not fulfill the labor minimum or who violate discipline may be deprived of the right to receive supplementary pay in part or in whole, according to the decision of the brigade or division council. Supplementary pay for division managers, brigadiers and their assistants is added on in the same manner as for ordinary kolkhoz members, providing that self-financing tasks in production output expressed in financial terms are fulfilled, costs are lowered and work productivity is increased. Supplementary pay is reduced by the percent of labor productivity reduction and production cost increase, but not more than by 50 percent.

The scale of progressively rising wage rates is simple and easily understood by the kolkhoz members. By means of its indices, the workers' labor is objectively evaluated.

In Money and In Kind

For many years, an operative procedure in the kolkhoz has been payment in kind and the sale of products to kolkhoz members, as well as assistance in the active participation of all kolkhoz members in voluntary production. From the established payment in kind fund, they are given free 0.8 kg. of grain for every ruble earned, but not more than one ton per worker. The managers and specialists, whose salaries exceed 100 rubles per month, are sold grain at wholesale price. In addition, tractor-drivers and machinists are each sold an additional ton of grain.

Milk is given free to the kolkhoz members on the basis of 400 grams for each ruble earned, while it is sold to the specialists at 24 kopeks per liter. Kolkhoz members who keep livestock and fowl for their own household may each buy 500 kg. of root plants, as well as silage and hay, from the kolkhoz board. Fruits and vegetables are given out and sold depending upon the fully developed crop of the current year.

The accepted procedure of distribution and sale of products in kind for labor permits the kolkhoz members to keep livestock and fowl and satisfy the needs of their families for vegetables, fruits and milk. The kolkhoz members supply themselves with meat at their own expense.

12249
CSO: 1828/85

IMPROVEMENT IN LABOR PRODUCTIVITY CALCULATION SOUGHT

Moscow EKONOMIKA SEL'SKOGO KHOZYAYSTVA in Russian No 12, Dec 83 pp 76-78

[Article by A. Nikishin]

[Text] The 26th CPSU Congress set a goal for the current five-year plan to increase labor productivity in the country's national economy by 17-20 percent and to obtain on this basis not less than 85-90 percent of the growth in the national income. During this time average annual production of agricultural output will increase by 12-14 percent and labor productivity in the public sector by 22-24 percent.

Labor productivity is connected with the development of all the conditions and factors pertaining to the labor process. However, the methodological problems of measuring labor productivity in agriculture have not yet been resolved. For more accurate measuring of labor productivity it is necessary to know two indicators: the volume of output produced and the amount of working time spent on its production.

In plant growing the quality of the product in value terms is determined according to the initially received volume, that is, without taking account of the contamination by weed seeds, earth and vegetative residue. Thus, according to report data, the volume of grain after final processing is 90-95 percent of that initially received. Up to 15 percent of the physical composition of the sugar beets sold to the state consist of earth around the roots and vegetative residue. Therefore in calculating the value of the gross output of plant growing, the admixtures are computed on the basis of the same price. For this reason the established method of calculation contributes to the overstating of the value of gross output and of the level of labor productivity.

Therefore, in calculating the value of the gross production of plant growing, its estimation must be made on the basis of the volume of output after the final processing, that is, when it is of a higher quality. "High quality--means economizing labor and material resources, the growth of export opportunities and in the end, a better, more complete gratification of social needs."*

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* Materialy XXV S"yezda KPSS [Materials on the 25th CPSU Congress], Moscow, 1976, p 4

Farms which sell higher quality agricultural products to the state have an advantage over farms which sell lower quality products. However, in determining the value of gross production, they find themselves in an identical situation. In order to produce higher quality products, additional expenditures of labor (zhivoy trud) and capital (proshlyytrud) are required. For this reason it is necessary to consider the quality of the output produced.

The quality of agricultural output has a quantitative measurement as well. Quality indicators differ both by types and by purpose. A considerable part of agricultural crops is intended for production purposes. This pertains to bast and oil-bearing plants, sugar beets, potatoes, vegetables and others. The merits of these products are determined by the content of the substances needed for production. With this evaluation of quality, each product has its own special feature. It is on this basis that comparable prices per unit of standard output should be calculated.

It is expedient to calculate the value of gross agricultural output taking quality into account. For example, output designated for sale to the state should be evaluated not on the basis of the actual volume but by the recorded volume since in it the quality of this output has already been taken into account. Seeds, however, are better computed on the basis of their volume, applying a coefficient of economic suitability determined on the basis of data from state seed testing laboratories. It is desirable to evaluate output designated for livestock feed on the basis of its physical mass using a quality coefficient which is defined as the relation of actual protein content of each type of feed to the established feed value. Here one must use data from the chemical analysis of the feeds.

For calculating labor productivity taking into account the working time spent for the production of output and for analyzing labor productivity for individual sectors, it is expedient to use only direct labor costs. For them, however, one cannot establish accurately the connection between labor cost and production results. At present the structure of direct labor costs is calculated inaccurately. Research conducted at the All-Russian Scientific Research Institute of Labor and Administration in Agriculture, has shown that in 50 farms in Tambov Oblast direct costs were, on the average, 94 percent of the overall magnitude of the inputs of working time attributed to production; in 140 kolkhozes--72 percent and in 73 kolkhozes--55 percent. The same expenditure of labor in some cases was included in direct costs and in others it was not. The fact is that with the development of technical progress the share of indirect labor costs increases constantly. For this reason one must consider also the costs connected with the administration and servicing of production in calculating the labor productivity level.

Indirect labor costs include the working time inputs of motor transport workers. With the development of technical progress the portion of motor transport in the over-all volume of shipments grows constantly. For this reason motor transport workers are direct producers of agricultural output. And their labor must be attributed to direct costs, not indirect costs.

The accounting of the production of output should be made more precise: basic, joint products and by-products. Here the correct distribution of labor costs by types of output acquires significance.

At the present time, their distribution is performed by means of standard coefficients, but they are insufficient. All labor costs for the production of output should be divided into two parts: labor costs directly connected with production of several types of products (from soil preparation to crop harvesting) and those attributed to one type of output received (crop harvesting and its final processing). This makes it necessary to arbitrarily distribute only the first part of the labor costs on the basis of specified coefficients and to attribute the second part directly to that type of output on which it was spent.

The procedure being suggested for determining the level of labor productivity is illustrated using the example of the production of individual types of output in the Vostok sovkhoz, Moscow Oblast, according to 1980 data.

	Level of labor productivity kilogram/man-hour according to the procedure	
	Existing	Recommended
Grain	69.5	49.0
Potatoes	71.3	56.8
Root vegetables	74.2	65.2
Perennial grasses		
for hay	124.5	99.0
green mass	414.6	311.6
seeds	1.6	1.2

Consequently, improvement of the procedure for calculating labor productivity in agriculture will permit one to determine more accurately the quantity of output produced taking its quality into consideration, and to more fully take account of the amount of labor used in its production. This also will make it possible to determine more objectively the level of labor productivity both in the sectors and in the production of individual crops. At present labor sets in motion an ever-growing quantity of means of production in which capital is included. Total labor costs for producing a unit of output consist of expenditures of labor and capital. Thus productivity is composed of expenditures of total (sovokupnyy) labor while the growth of its productivity is expressed in the saving of all total labor.

In USSR agriculture, only labor outlays are taken into account in working time, while capital outlay is calculated in value form. Therefore, in determining total costs, it is necessary to convert material expenditures given in monetary terms into a labor measurement by means of a special procedure. The basis of

the accounting of the expenditure of total labor in agriculture is the costing (proizvodstvennaya kal'kulyatsiya) of production cost. For agriculture, a number of procedures have been proposed for calculating the total labor costs, taking into account the specific character of this sector. Of all the existing procedures for calculating the total labor costs in agriculture, we selected as a basis the procedure of Professor Ye. S. Karnaukhova. This procedure is the most perfect in theory as well as simple and accessible in practice. In essence she recommends using actual data on the production cost of past industrial and agricultural capital with their subsequent conversion into a labor measurement.

In the process of investigating this procedure, several changes were introduced. This is related to the double counting of indirect labor costs. According to this procedure they are simultaneously accounted for in the structure of expenditures of labor and industrial capital (indirect labor costs are part of the aggregated classes of outlays for fuel and lubricants, motor transport, current repair of fixed assets--in the form of wages which in the calculation process are not removed from the structure of these classes but are attributes to outlays of industrial capital). The following changes were introduced into the calculation process for this procedure; indirect labor costs (according to the share of wages in them) are segregated from the aggregated classes of expenditures (fuel and lubricants, motor transport, current repair of fixed capital); labor cost calculations in the classes of expenditures for seed, fertilizer and other expenditures are corrected.

The structure of total labor includes labor costs (direct and indirect) and capital outlays. In this connection, the following are segregated in each class of the costing of output: indirect labor costs (the labor of workers connected with functions of the administration and servicing of production); outlays of agricultural capital (seed, feed, organic fertilizers); of industrial capital (mineral fertilizers, fuel and lubricants, purchased seeds and feed, machines, equipment, etc.). At the same time, calculations of total labor costs are carried out in the following order: labor costs are determined from the annual report data of farms; after segregating labor inputs from the aggregated classes, expenditures of agricultural and industrial capital in value form are segregated by classes of expenditures; the obtained value of agricultural capital outlays in value form in expenditures for seed are corrected by the value of industrial expenditures occurring here; a break-down of outlays for fertilizers by their types (mineral and organic), corresponding to the outlays of industrial and agricultural capital is produced on the basis of established proportions using annual report data; on the basis of the interpretation performed the groups of expenditures of agricultural and industrial capital are classified in value form. Then expenditures of agricultural and industrial capital are determined in labor measurement.

The total labor-intensiveness of production, which along with the total amount of labor expended for the production of output, permits one to see the changes in its structure is determined on the basis of the data obtained. Total labor costs for producing agricultural output are determined on the basis of the system developed and are presented in the table.

Total Labor Intensiveness for the Production of the Output of the Vostok Sovkhoz Moscow Oblast, Average man-hours per year

	Grain		Potatoes	
Years	1971-1975	1976-1980	1971-1975	1976-1980
Total labor expenditures for 1 quintal of production:				
Labor, total:	3.00	2.39	2.54	1.83
Including, direct:	1.48	1.29	1.37	1.08
indirect:	1.52	1.10	1.17	0.75
Capital, total:	5.64	6.15	6.81	5.92
Including, agricultural:	1.47	2.21	3.67	2.94
industrial:	4.17	3.94	3.14	2.98
Total labor expenditures for 1 hectare of sowing:	8.64	8.54	9.35	7.75
Labor, total:	77	58	391	223
Including, direct:	38	32	211	132
indirect:	39	26	180	91
Capital, total:	144	151	908	830
Including, agricultural:	38	54	451	448
industrial:	106	97	457	382

As is seen, total labor intensiveness of production dropped.

Thus, improvement of methodological bases for measuring labor productivity in agriculture permits one to determine more accurately the quantity of output produced taking its quality into account and to account for total labor expenditures in its production and on this basis to obtain a more accurate idea of the nature of the growth of the productivity of labor and of reserves for its economy.

12484
CSO: 1828/68

MEASURING OF PROFESSIONAL WORK PERFORMANCE DESCRIBED

Moscow SOTSIALISTICHESKIY TRUD in Russian No 1, Jan 84 pp 43-51

[Article by V. Palitsyn, department chief of the Belorussian Branch of the Scientific Research Institute of Labor and candidate of economic sciences: "How to Measure the Work Efficiency of Specialists?"]

[Text] There are approximately 30 million specialists with higher and secondary educations working in the country at this time. They play an important role in speeding up scientific and technical progress, intensifying production and increasing its efficiency. Meanwhile, the realization of this huge creative potential requires continual improvement in the specialist work stimulation system, based on a very well-rounded evaluation of the personal contribution of each one to the total results, something which is not simple to do.

Everyone knows that the method that has been tried most often is that of labor standardization, the establishment of norms for work time expended. However, the standardization of labor for specialists is not the same thing as setting standards for machine work output or standards for servicing equipment. In the case of specialists, most types of work demand creativity and research. In this regard, the standardization of their labor is based on the use of different methods[1]. Thus, time quotas and standards are calculated in many design, planning and scientific research jobs; in nonstandard and seldom repeated jobs, number or service quotas and number ratios of different categories of employees with consideration of production factors (cost of basic production assets, volume of production, etc.) are determined. For stable, similar and repeatable operations based on an analysis of labor expenditure a wise balance of work time and labor intensiveness tables are set up and specialist functions are redistributed.

Each of these methods has its shortcomings, which limits their use in practice. Indeed, production standards in planning and design work place the specialist in a position where he is interested in finishing a great deal of work without showing any creative activity, for he is limited by a rigid framework of time quotas. Who needs a large amount of intermediate work without good final results? Isn't this why mountains of projects lie around getting stale, stored for the future and then written off as

obsolete? Here the negative role of rigid norm-setting is evident. It is all the more problematic to determine labor expenditure norms for work done by scientific associates, functional service specialists, etc. And yet there are still many proponents of rigid norm-setting regardless of the sphere of human activity. For a while attempts were being made to develop rigid norms for scientific associates engaged in theoretical research. This undertaking is clearly a hopeless one.

How then to regulate specialist labor expenditure? There must be norms, nevertheless. Work surely must be evaluated. The search for more perfect methods of evaluating the work efficiency of specialists is constantly going on. It is recommended that professional qualities, work results and production function complexity be evaluated by an expert method.[2] Each element of the evaluation is characterized by certain attributes. Professional qualities are competence, the ability to accurately organize and plan one's work, awareness of responsibility for work to be done, independence and demonstration of initiative, ability to maintain contacts with other people, etc. Work results are the quantity and quality of plan and above-plan jobs and the observance of fixed periods for their completion. Production functions complexity includes novelty and elements of creativity, complexity of technological processes, variety of work, additional responsibility for work results.

Professional qualities, work results and production function complexity are evaluated by a point system. This is how the overall evaluation of labor contribution is calculated. The basic shortcoming of this method is that it is based on the subjective judgments of experts and not on objective systematic recorded data of labor expenditure and results of specialist activity.

Another known method is that of the Pul'sar System, used at the Lvov Electron Association. Specialists' labor is periodically evaluated there according to the following indices: complexity, quantity and quality of work, specialist participation in technical creativity, professional competence and efficiency, organizational capabilities, executive ability, initiative, relationships with colleagues, discipline, understanding of principles and sociopolitical activity. An individual chart is drawn up for each engineering technical worker, wherein his immediate supervisor evaluates the associate's professional and personal qualities according to a 5-point system. Based on the summarized evaluations, the top 10 percent of workers are determined, thereby earning a transfer to higher responsibilities; 10% of those receiving the lowest evaluations are transferred to a lower position for this reason[3]. An economic incentive system is also set up in accordance with the evaluations. In the Pul'sar system specialists' professional and personal qualities are once again determined on the basis of expert opinions, in particular the immediate supervisor's. At the present time, systems for the supervision of production quality which involve the use of a quality coefficient are being used in many enterprises. This is also an attempt to give a specific evaluation of work quality to the worker, but

quality coefficients basically encompass executive, technological and labor discipline.

Thus, as before the traditional method of evaluation according to skill and experience prevails, but how, for example is skill determined? The only objective data here are those concerning education and length of service. , but they also can give a false representation. Actually, skill depends on the education received at the VUZ, experience obtained in the process of working, instruction in various specialized classes and independent literature study. Even immediately upon graduation from the VUZ, young specialists arrive with different skills and different levels of scientific and technical knowledge. In the actual work process, the knowledge acquired at the VUZ is consolidated and developed or, on the contrary, becomes obsolete. Everything depends on what types of stimuli and interest there are and, of course, on individual capabilities.

It can be maintained that a specialist with a higher education and long work record will fulfill more complicated functions than a specialist with a higher education and a shorter length of service. At the same time, is such an assertion always valid? If one specialist's length of service is 15 years and another's is 2 years, then in this case the first one clearly has the advantage. However, what if one's length of service is 15 years, another's is 12 years and a third's is 10 years? Will a difference such as this have an effect on the specialist's skill? For all practical purposes, it will not.

Thus, one cannot measure the scientific and technical skill level of a specialist by education and length of service. What, then, can be used? The content of official functions is extremely significant for characterizing the skills and scientific and technical level of specialists, but how can this content be measured quantitatively? How do we compare, for example, the complexity of jobs done by a senior economist and a chief economist and by first and second category engineers? Simple comparison of the functions allows one to say that one job is more complicated than the other. But to what degree? Comparison of the functions does not answer this question.

All of this has a negative effect on the sociopsychological climate in the collective. Indeed it is practically impossible to fully realize the principle "From each according to his abilities, to each according to his labor." A subdivision supervisor cannot say specifically how much better or worse each specialist worked on that day.

In practice, the evaluation of specialists' work for the time being is primarily divided into two approaches: on the one hand, a general, very rough traditional evaluation based on data concerning education, work experience, duties engaged in, expert judgments concerning personal and professional qualities and on the other hand rigid norm-setting based on division of work into small operations and detailed regulation of specialists' actions. Measurement of the complexity of work, of results achieved and personal contribution are missing in the first case, and in the second case opportunities for creativity are severely limited.

At the Belorussian Branch of the Labor Scientific Research Institute an evaluation system was developed allowing sensible regulation of activity while leaving enough room for intensive creative research and the achievement of good end results. The scientific associates at the institute decided to try it out on themselves so as to be convinced of its effectiveness. What is the essence of this method?

Each specialist fulfills functions established by a qualifications handbook for ITR's [technicians] and employees and by official instructions developed to be applicable to production characteristics and work to be done. It follows that if work volume is not measured and labor, creative and social activity is not evaluated, then a judgment on specialists' activity can be made only according to how they perform their duties. This, however is a very primitive evaluation. The important thing is that a specialist not be able to get "locked in" to his functions alone. Then his skills, scientific and technical level and the development of his creative activity would cease to grow. According to the official instructions, execution of certain jobs is assigned only to a specialist at a certain skill level. As his experience and knowledge accumulate, he oversteps the limits of the instructions. An economist gradually masters the functions of a senior economist, etc. However, a strictly fixed system of duties and corresponding salaries serve as obstructions to the development of specialists' capabilities, since they lack continual interest in replenishing their knowledge. This is why individual specialists can often be observed trying to get higher paying duties for themselves sooner, and then they can just "sit tight." Moreover, the instructions' requirement to do only the indicated job duties does not give specialists the incentive to expand their activities and does not interest them in the development of interchangeability, plurality of professions, nor collectives in freedom from the numbers. Each specialist must become interested in the fact that he should not only conscientiously fulfill his owm immediate functions as determined by the instructions, but also more complex ones.

The work of specialists in our branch is characterized by functions (jobs) to be done which are broken down into classes according to the degree of complexity. Criteria for the classification of functions (jobs) according to complexity were amounts of information to be processed, complexity of functions to be fulfilled and the degree to which problems to be solved were nonstandard ones (Table 1). The number of classes of complexity is determined according to the number of specialist function groups and equals 5. Specialist function groups are formed according to qualifications, salary amounts, and functions and jobs to be done (Table 2).

In accordance with specialist function groups, functions (jobs) are classified according to increased complexity. Five groups of functions (jobs) have been formed. For example, the 2nd class of job complexity has the following scope: collection of reference information from routine, statistical and bookkeeping reports, filling out forms (interviewing), taking care of research objects, preparation of information for computer processing, and performing analytical calculations according to a given algorithm.

Table 1. Principles for Complexity Classification of Functions To Be Fulfilled.

(1) Классы сложности должностных функций (работ) / (7) Элементы сложности функций (работ)	(2) Технические специалисты (1-й класс)	(3) Специалисты (2-й класс)	(4) Старшие специалисты и старшие научные сотрудники (3-й класс)	(5) Ведущие специалисты и старшие научные сотрудники (4-й класс)	(6) Заведующие отделами, секторами и лабораториями (5-й класс)
(8) Объем перерабатываемой информации	(11) Нарастает от 1-ого к 5-ому классу ⇨	⇨	⇨	⇨	⇨
(9) Сложность технологии выполняемых функций (работ)	(11) Нарастает от 1-ого к 5-ому классу ⇨	⇨	⇨	⇨	⇨
(10) Степень нестандартности решаемых задач	(11) Нарастает от 1-ого к 5-ому классу ⇨	⇨	⇨	⇨	⇨

Key:

1. Complexity classes of official functions (jobs)
2. Technical specialists (1st class)
3. Specialists (2nd class)
4. Senior specialists and senior scientific associates (3rd class)
5. Chief specialists and senior scientific associates (4th class)
6. Chiefs of departments, sectors and laboratories (5th class)
7. Elements of complexity of functions (jobs)
8. Amount of information to be processed
9. Technological complexity of functions (jobs) to be performed
10. Degree to which problems to be solved are not standard
11. Increases from the 1st to the 5th class

In the same manner, other groups of jobs are organized according to complexity on the basis of report documents and personal creative plans. Analysis makes it possible to identify jobs that belong or do not belong within the scope of certain positions, to see how wisely specialists are being used in accordance with their skills, how busy they are, and whether or not their job placement is correct. This in-depth analysis of work to be done makes it possible to devise specific measures to improve personnel placement and increase specialist labor efficience. During this period, work area inventory and certification are done.

How does one interest specialists in doing work with a higher degree of complexity? To do this their labor must not be evaluated approximately, but on the basis of work time expenditure data for specific types of work done. This is the reason for calculating complexity coefficients according

Table 2. Calculation of the Complexity Coefficient For Work To Be Done (Functions)

Группа сложности, функций (работ) (1)	(2) Группы должностей специалистов	(3) Средний оклад по группе (руб.)	Коэффициент сложности (4)
(5) 1-й класс	Технические исполнители (6)	100	1,00
2-й класс	Специалисты (7)	130	1,30
3-й класс	Старшие специалисты и младшие научные сотрудники (8)	160	1,60
4-й класс	Ведущие специалисты и старшие научные сотрудники (9)	220	2,20
5-й класс	Зав. отделами, секторами, лабораториями (10)	330	3,30

Key:
1. Complexity, functions (jobs) group
2. Specialist job groups
3. Average salary by group (rubles)
4. Complexity coefficient
5. 1st, 2nd, etc. class
6. Technical employees
7. Specialists
8. Senior specialists and junior scientific associates
9. Top specialists and senior scientific associates
10. Chiefs of departments, sectors and laboratories

to every kind of work. This is how it is done. The plan for job salaries reflects a varying complexity of work ratio. A predetermined salary corresponds to each complexity class. Simple labor is at the lowest rank of complexity. It is expressed in the average salary of senior technicians and technicians. If the average salaries of all job groups are correlated with the average salary of senior technicians and technicians, then it is possible in our opinion to express all types of complex labor through simple labor. We obtain a table of coefficients which will reflect the organization of specialists according to skills, i.e., according to potential ability to fulfill tasks of a definite complexity. The coefficient of simple labor corresponds to a unit. Values of coefficients increase in proportion to increased complexity in work to be done and salary increases (Table 2).

In individual specialist plans for every month, organizational subdivision supervisors determine types, amount and time periods for accomplishment of work and labor expenditure in man-days, based on a work fulfillment calendar graph arranged by subject, enlarged quotas, actual labor intensiveness of similar jobs done in past periods and an increase in labor productivity due to the use of technical means and enactment of other measures. Jobs are allocated taking into consideration education, skill and

experience of the specialists. Over the course of a month the specialist records in his personal plan the actual periods for meeting quotas, above-plan, rush and overtime jobs, and labor expenditure according to types of work. The subdivision supervisor inspects the jobs, determines whether they correspond to the requirements of the standards and quotas established and records the complexity coefficients for each job.

Labor with a differing complexity is related to simple labor by multiplying labor expenditure in man-days for each type of work by the appropriate complexity coefficients. Thus a coefficient-day equal to the average amount of simple labor expended in one day by a specialist with the lowest qualification is used to express specialist labor expenditure and labor intensiveness. A comlexity coefficient of higher class work is used to evaluate rush, above-plan and overtime jobs. When quotas are being met with a disruption in standards and established norms, output is decreased by the labor expenditure value necessary for eliminating shortcomings or defective products.

For example, in accordance with the scientific research work subject plan, the labor resources sector chief determined in the department senior economist's individual plan for June 1983 the types, amount and time periods for accomplishing work and labor expenditure in man-days (see Table 3). The specialist filled the quota early, using 18 days instead of the 22 foreseen in the plan. He was entrusted with an additional USSR Goskomtrud [State Committee of the USSR Council of Ministers for Labor and Salary] rush quota. When rush quotas are filled, work complexity increases by one class. Because of the overfulfillment of the plan quota and the completion of additional rush work, the specialist's output was not 35.2 (12 X 1.6 + 10 X 1.6), but 44 (35.2 + 8.8) coefficient-days.

Everyone is now interested in early plan completion and in completing extra work, more rush jobs and work that is more complicated. A specialist tries to raise his qualification and expand the sphere of his activity, knowing that this will be counted not in 3-4 years when he is transferred to a higher position, but right away. In this case it does not work to hide behind old honors. Prior to the introduction of the new evaluation method, specialists tried to avoid extra work; now they themselves come to the supervisor requesting to be given more complex and responsible work.

A fact of no small importance also must be mentioned. Jobs that are considered monthly and characterized by complexity coefficients reflect only an intermediate result and are determined by output in coefficient-days. But the work of specialists is aimed toward the achievement of a definite final goal--economy of expenditure by implementing this research, the attainment of high economic effect, and a reduction in labor intensiveness and product materials intensiveness. How do we sort out individual specialists' participation from the final results? By using reporting data from past years a calculation is made statistically of normative labor intensiveness in coefficient-days of a unit of economic effect as well as a reduction in labor intensiveness and materials intensiveness of production (services), etc. By using the normative labor intensiveness of a unit of final result,

Table 3. Content of Individual Work Plan Of Senior Economist I. Petrovich for June 1983

(1) Раздел 1

(2) Планируемые работы	Плановые сроки выполнения (3)		Затраты труда по плану, чел.-дней (6)	Коэффициент сложности (7)	Выработка (коэффициенто-дней) (8)
	начало (4)	окончание (5)			
Тема 3.5.1 (9)					
1. Анализ информации с использованием метода группировки и регрессии (10)	1.06	16.06	12	1.60	19.2
2. Обобщение и первичное описание результатов обработки информации на ЭВМ (11)	17.06	30.06	10	1.6	16.0
Итого (12)			22		35.2

(1) Раздел 2

Выполнение работ (13)	Фактические сроки выполнения (14)		Затраты труда (человеко-дней) (15)	Коэффициент сложности (7)	Выработка (коэффициенто-дней) (8)	Выработка по плановой трудоемкости (коэффициенто-дней) (16)
	начало (4)	окончание (5)				
Тема 3.5.1. Плановые работы (17)						
1. Проанализирована информация с использованием метода группировки и регрессии (18)	1.06	10.06	8	1.60	12.8	19.2
2. Обобщены (с первичным описанием) результаты обработки информации на ЭВМ (19)	13.06	24.06	10	1.60	16.0	16.0
Итого (12)			18		28.8	35.2
Дополнительные работы (20)						
Срочное задание Госкомтруда СССР (21)						
1. Проанализирована информация и сделано первичное описание результатов внедрения бригадного метода организации труда и стимулирования труда на объекте (класс сложности повышается в связи со срочностью задания) (22)	27.06	30.06	4	2.20	8.8	8.8
Итого (12)			22		37.6	44.0

[Key on following page.]

Key: [Table 3, preceding page]

1. Section 1, 2
2. Planned Work
3. Planned completion periods
4. Beginning
5. End
6. Labor expenditure according to plan (man-days)
7. Complexity coefficient
8. Output (coefficient-days)
9. Subject 3.5.1
10. Information analysis using grouping and regression method
11. Correlation and primary description of results of computer data processing
12. Total
13. Work completion
14. Actual work completion periods
15. Labor expenditure (man-days)
16. Output according to planned labor intensiveness (coefficient-days)
17. Subject 3.5.1 Plan Work
18. Data analyzed using grouping and regression method
19. Correlated (with primary description) results of computer data processing
20. Extra work
21. USSR Goskomtrud rush job
22. Data analyzed and primary description done of results of implementation of brigade method of labor organization and labor stimulation in subject (complexity class raised due to rush job)

its total standard labor intensiveness is determined, which is then allocated proportionally to the personal contribution (in coefficient-days) of specialists.

In this manner determination is made of the personal contribution of specialists to the economy of resources, materials, fuel and electrical energy, to the reduction in labor intensiveness and materials intensiveness of production and to the achievement of other economic results. In order to evaluate the labor of specialists and collectives a single measuring device is used--coefficient days--thanks to which an intrinsic connection of individual results with total ones is guaranteed. Specialists' work is evaluated according to their personal achievements, which in turn depends on collective ones.

It is very important to know a specialist's output per ruble of his salary, and this can be calculated by dividing output in coefficient-days into annual salary. This is how it becomes clear who worked and how, taking into consideration how much he got for it. The opportunity presented itself to determine statistically the normative output for each job group of workers and to compare it to the actual (Table 4, col.14, 15). Economy, work discipline, executive ability and other elements characteristic of a

Table 4. Results of Specialists' Work at Labor Resources Sector, First Quarter, 1983

№ п/п (1)	Ф., и., о. (2)	Должность (3)	Годовой оклад, тыс. руб. (4)	Оценка результатов деятельности специалистов, коэффициенто-дни (5)									Норматив в коэффициенто-днях (14)	Выполнение норматива, % (15)
				по трудоемкости и сложности работ (6)	по законченным результатам и эффекту (7)	итого (8)	коэффициент качества (9)	с учетом коэффициента качества (10)	с учетом оклада (11)	по общественной активности (12)	по общей выработке (13)	с учетом оклада (11)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Белоусов Г. В. (16)	Старший научный сотрудник (27)	2,600	140	140	280	0,9	252	96,9	10	262	100,8	120	84,0
2	Иванов И. И. (17)	То же (27)	2,400	160	140	300	1,0	300	125,0	33	333	138,8	120	115,6
3	Беленький Ф. И. (18)	»	2,400	140	150	290	1,0	290	120,8	15	305	127,1	120	105,9
4	Дедков Л. М. (19)	Младший научный сотрудник (28)	1,800	100	80	180	1,0	180	100,0	—	180	100,0	100	100,0
5	Михайлович В. С. (20)	То же (28)	1,920	100	80	180	1,0	180	93,8	10	190	96,96	100	96,9
6	Рыжевич С. Т. (21)	»	1,920	100	70	170	0,8	136	70,8	15	151	78,6	100	78,6
7	Петрович И. П. (22)	Старший экономист (29)	1,800	110	80	190	1,0	190	105,5	15	205	113,9	100	113,9
8	Волович В. П. (23)	Экономист (30)	1,560	75	60	135	1,0	135	86,5	—	135	86,5	80	108,1
9	Кривич С. (24)	»	1,440	80	40	120	1,0	120	83,3	10	130	90,3	80	112,8
10	Алехнович Г. И. (25)	Старший техник (31)	1,320	58	35	93	1,0	93	70,5	5	98	74,2	70	106,0
11	Стручкова В. Б. (26)	Техник (32)	1,200	60	30	90	1,0	90	75,0	10	100	83,3	70	119,0
	Итого (8)			1123	905	2028		1966	1028,1	123	2089	1090,46		

[Key on following page.]

Key: [Table 4, preceding page]

1. No.
2. Name
3. Function
4. Annual salary, in thousands of rubles
5. Evaluation of results of specialists' work, in coefficient-days
6. According to labor intensiveness and work complexity
7. According to finished results and effect
8. Total
9. Quality coefficient
10. With consideration of quality coefficient
11. With consideration of salary
12. According to social activity
13. According to total output
14. Quota in coefficient-days
15. Fulfillment of quota, %
16. Belousov, G. V.
17. Ivanov, I. I.
18. Belen'kiy, F. I.
19. Dedkov, L. M.
20. Mikhaylovich, V. S.
21. Ryzhevich, S. T.
22. Petrovich, I. I.
23. Volovich, I. P.
24. Krivich, S. S.
25. Alekhnovich, G. I.
26. Struchkova, V. B.
27. Senior scientific associate
28. Junior scientific associate
29. Senior economist
30. Economist
31. Senior technician
32. Technician

specialist's attitude to his work are reflected in the work quality coefficient. In the final analysis, the evaluation of results of their work with consideration of salaries is corrected to the work quality coefficient (see Table 4, column 9).

An overall evaluation of work results is used in the certification of specialists. The content of jobs to be done, their complexity and their conformity to education and skills are analyzed on the basis of individual plans. The specialist's ability to gets results with his labor, his economic effectiveness and creative and social activity are determined from data of this record of creativity. His participation in socialist competition is kept track of: prizes won within the subdivision (sector, laboratory, department) and among specialists in the same profession (position). Based on an evaluation of results of specialists' activity in

coefficient days it is possible to apportion bonuses and set salary bonuses.

The approach to the payment of bonuses changes in a radical fashion. Everyone known that in practice it is allotted in proportion to salary, taking into consideration the work quality coefficient. If this coefficient is the same, then it is received in this manner: the higher your salary, the more the bonus will be. However, this is not true in principle. The bonus should be higher for the person who made the more significant contribution to the total result. It is just such a principle that is built into the new method. The more and better you do, the more you will receive. The bonus is allocated not according to your salary, but according to the number of coefficient-days. Because of the bonus, the total pay of a specialist with a small salary can exceed that of specialists with high salaries.

An objective evaluation of labor makes it possible to characterize the work of a specialist from various aspects. If he is not fulfilling a quota, this means that there are shortcomings in his work. If there is a low evaluation characterizing work complexity, then the specialist is either fulfilling functions not characteristic for him or working in a relaxed fashion. If there is low economic effect, this indicates insufficient creative activity on the part of the specialist, and the fruitlessness of his work. Analysis of jobs to be done and time spent makes it possible to identify the true reasons for lagging behind. The procedure offers an opportunity for getting rid of formalism in competition and wage leveling. Previously only winners in the departments were determined, and only those who were highly visible. And how were the rest of them working? No one knows. Now each associate's reasons for not meeting quotas are being reviewed. Results of labor have become visible. It is possible to see who worked and how, who is behind, who is going ahead, who must be kept up with.

The work of departments, sectors (laboratories) and consequently of their supervisors is evaluated by implementation of an approved research plan. Moreover, collectives are directed toward a reduction in the labor intensiveness of work. A work expenditure quota is approved for each type of them. Extra work is done as a result of time saved, and if there is not enough work in that place, specialists are released and sent into other subdivisions. In addition to this, the work of the structural subdivisions is evaluated according to economic effect and other indices. Money allocated for bonuses is distributed among structural subdivisions according to results achieved, as expressed in coefficient-days.

Our branch has been using this method for five years already. In the first years of its use the economic effect obtained by implementing the study grew from 63,000 rubles to 179,000 rubles. Research periods prior to the obtaining of finished results were cut approximately in half. The collective began to fulfill its quotas more efficiently. The simplicity and universality of the method under discussion has caused a great deal of interest. Collectives from a number of industrial enterprises, construction

organizations, construction buros and even publishing house workers have started to implement it. It is suitable anywhere where the development of rigid time quotas is impossible or inappropriate.

FOOTNOTES

1. Norm-setting of labor for employees. Procedural instructions. Moscow, Labor Scientific Research Institute, 1979.

2. Procedural recommendations on the evaluation of work qualities and work results of enterprise designers and technologists for certification and salary fixing. Moscow, Labor Scientific Research Institute, 1979.

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ROBOTICS IMPACT ON LABOR PRODUCTIVITY EXAMINED

Moscow SOTSIALISTICHESKIY TRUD in Russian No 1, Jan 84 pp 52-54

[Article by F. Mikhaylov of the Kazan Finance and Economics Institute: "Industrial Robots and Their Impact on Productivity and Conditions of Labor"]

[Text] Production of industrial robots (automatic manipulators) is growing extremely fast in our country, considerably surpassing the output of other kinds of automated equipment. Thus, in 1981 compared to 1975, according to the average annual rate of growth it surpassed the output of machines with numerical programmed control by 17.3-fold and of complete sets of automatic and semiautomatic lines for machine building and metalworking by 82.8-fold.

Acceleration in the production of industrial robots is called upon to aid in solving most important socioeconomic tasks of the present stage in the development of the economy: to ensure the planned rates of increase of labor productivity and production efficiency, to reduce hard manual and monotonous labor to the maximum and to make work safe. This, as noted in a speech at the June (1983) plenum of the CPSU Central Committee by Party Central Committee General Secretary Yu. V. Andropov, "will bring closer a solution of one of the main tasks of communist construction--the task of overcoming the substantial differences between manual and mental labor."

The practice of modern production testifies that the use of automatic and semiautomatic lines alone as well as semiautomatic machines of various type (without industrial robots) often does not permit achieving these goals simultaneously. Thus, it is known, the productive means of semiautomatic machines can be increased by raising the speed of their operation. The studies conducted in 1974-75 at motor vehicle plants of our country have shown that the automatic working cycle of semiautomatic machines amounted to 1-5 minutes.[1]

In measuring the duration of the automatic working cycle of semiautomatic ma-- machines, which are currently in operation at the Kamskiy Motor Vehicle Plant [KamAZ], it varied from 0.5 to 3 minutes. At the same time, with the increased speed of automatic working the frequency in fulfilling a complex of manual procedures in servicing semiautomatic machines also increases. The increase of labor productivity of semiautomatic machine operators is linked to a substantial rise of its intensiveness owing to the great volume of work, which is performed in a forced pose and under considerable monotony of labor.

Substitution of manual labor on automatic lines is usually accompanied by an increase of links in the automatic system chain. The reliability of an automatic line in this case is reduced even under the condition of high reliability of its every link individually. Studies by scientists have shown that the reliability of the system decreases in geometric progression as the number of successive connected elements grows. Naturally, regardless of how high the productive means of an automatic line may be, it is extremely difficult to plan its work results under the conditions of limited reliability. The negative consequences of high nervous and mental tension of the personnel servicing the line owing to constant tense waiting should also be borne in mind.

The country's plants are now engaged in series production of first generation industrial robots (automatic manipulators). A review of their utilization, according to press data, show that at least 95 percent of the entire output beongs to the materials handling class. Primary use of such equipment in materials handling work is explained by the fact that it can reproduce mechanical operations only in a strictly programmed sequence and at a fixed pace. To a great extent these limitations satisfy materials handling work, including auxiliary operations of units with cyclic automation and machines with numerical programmed control [ChPU].

The reserves for economizing work places by introducing first generation industrial robots are great. Thus, it is expected that 20 percent of all machines in machine building and metalworking will be replaced by machines with numerical programmed control.[2] A special analysis, which was conducted by the Ministry of the Machine Tool and Tool Building Industry [Minstankoprom], has shown that out of the overall list of machine tools that have been prepared for output in the 11th Five-Year Plan more than 400 can be equipped with industrial robots.[3]

During the seventies, the world practice has revealed certain principles of efficiency in using automated equipment, including industrial robots. This, first of all, is the maximum daily use of such equipment and its group utilization. When individual domestic enterprises violated these principles in organizing the functioning of industrial robots, such equipment yielded a low effect.[4] Broad dissemination of industrial robotics in our country as well as throughout the world has indicated that there are also special rules in existence which should be used as a guide when introducing automatic manipulators. Thus, specialists of the GDR devote great attention to production preparations. In particular they study the possibility of integrating equipment within the framework conditioned by production technology with the aim of creating large robotized cmplexes, explore auxiliary operations for servicing such equipment which must be performed by robots and so forth.[5] It must be noted that the GDR now shares second-third places in the world for the number of industrial robots introduced,[6] and therefore the experience of that country's specialists in the field being examined deserves a detailed study.

To use automatic manipulators effectively it is extremely important to consistently strive so that all workers of enterprises, especially auxiliary workers, would master the achievements in the field of production automation. There are no serious bases for conclusions that the specialists who service indus-

trial robots must possess a specific skill and know-how. In reality their professional know-how in most cases is connected with production technology, which is identical to industrial robots or that comparable to them. No serious problems with servicing and using robots have been observed at enterprises which are efficiently using automatic lines, machines with numerical programmed control and automatic loading devices.

Industrial robots are now being introduced and included in existing technical systems by combining them with equipment in designing which the interrelationship with robotics was either not taken into account or was not strictly compulsory. This makes it necessary to manufacture special equipment in order to ensure precise positioning of components and mechanisms for automating the feed as well as transferring unfinished work pieces, shifting finished products (semimanufactures) of a given sector, removing shavings and so forth. A robotics complex [RTK] is formed at production sectors where automation of the link of basic and auxiliary operations performed by industrial robots is achieved in this manner. The resolution of the CPSU Central Committee and the USSR Council of Ministers "On Measures for Accelerating Scientific and Technical Progress in the National Economy" names broad automation of technological processes on the basis of using modern and progressive equipment and particularly robotics complexes as one of the main directions of work. Productivity of each one is determined by design-kinematic features of the equipment included in it and depends on the reliability of functional systems, the quality of unfinished work pieces and labor discipline of specialists servicing a complex.

The source of productivity growth of automated equipment, which is fitted out with industrial robots, lies in raising the speed in performing auxiliary operations. The manual loading and unloading cycle in working on automated equipment often exceeds the automatic components working cycle 2-4 fold, which, first of all, limits the productivity of given equipment. The use of industrial robots makes it possible to reduce the duration of auxiliary operations and thereby to increase equipment efficiency 1.5-3 fold, especially when the components being worked on weigh more than 30 kg. It is is precisely in working on massive components that the advantages of robotics are most clearly manifested over traditional means of mechanization of loading and unloading work (overhead-track hoists, telphers, winches), which are ineffective and inconvenient in servicing modern equipment under conditions of short distance but frequent movement of unfinished work pieces and components. Thus, if an operator tries to speed up the work, the swinging amplitude of an unfinished work pece that is moved with the aid of a load-carrying device increases and this complicates its positioning, creates a danger of impact and as a consequence causes damage to the equipment. The use in similar work of a Pirin (People's Republic of Bulgaria) gantry robot, which has proven itself at the Kamskiy Motor Vehicle Plant, makes it possible to reduce the auxiliary time in loading machines by 30-40 percent and, at the same time, ensure precise and shockless positioning of a component. Equipment productivity in this case increases by an average of 25-30 percent.

The advantages of automatic manipulators are not as obvious when unfinished work pieces weigh less than 5 kg. The output of semiautomatic machine operators often exceeds the efficiency of robotics complexes with similar basic

production equipment. Thus, the average productivity of series industrial robots RF-20/M, MP-9s and Tsiklon-3B in servicing presses is 2-2.5 fold lower than the ouput of a skilled press operator. This is explained by the fact that such robots, owing to their design features, are capable of performing no more than 12 auxiliary operation cycles in servicing a press per minute.[7]

Raising the manipulation speed of industrial robots, if necessary protective devices have not been developed, increases the danger of traumatism because the active zone of operations of such mechanisms cannot as yet be fully isolated from work places, which is explained by a number of circumstances. First of all, the first generation robots are not capable of self-regulation. Their instruction, that is reproduction by an operator according to assigned coordinates with regard to objects of storing the entire complex of operations which are registered by transmitters for transmission to the memory of a program device (a microprocessor), is implemented as yet mainly manually. Second, the limited functional possibilities of automatic manipulators make it necessary to create contact robotics systems (complexes), which provide for the existence of direct links between an operator and a robot. For example, in stamping production such complexes are formed because the use of first generation industrial robots cannot ensure reliable fixing of unfinished work pieces or when owing to design features of the die the form can be extracted from it only by hand.

Contiguous links in the contact robotics complexes are, of course, not provided by technology, moreover they are forbidden. They arise as a result of defects in planning equipment and technology, when, for example, the transportation means do not ensure reliable orientation of unfinished work pieces in the process of transporation. In such a case an operator is forced to periodically push an unfinished work piece from the conveyer under the robot's gripping device. A functional interaction of man and mechanism occurs, which contains a danger of traumatism. Even when the use of automatic manipulators excludes manual labor in performing auxiliary operations, there is as yet a need for frequent intervention by an adjuster and repairman in connection with replacing an instrument, tuning, adjusting and repairing a robot as well as industrial equipment. Therefore, rational planning of industrial robots is of extreme importance in order to ensure a convenient and safe access by servicing personnel to functional mechanisms of robotics complexes. It must be noted that by the present time the basic safety requirements, which should be taken into account in designing robots and their planning in industrial complexes, have been developed as a whole.[8] However, implementation of the given principles and rules in practice becomes complicated, since the predominant majority of industrial equipment is designed and its planning is implemented in the best case by taking scientific labor organization [NOT] requirements into account but without considering the subsequent equipping with automatic manipulators.

The history of equipment development shows that every great technological achievement entails a situation which has a certain degree of risk. This also applies to industrial robots, but the potential possibility of traumatism in consequence of their use is incomparably less than those dangerous production factors which are excluded as a result of introoducing such automated equipment. Thus, it

makes it possible to completely avoid damaging man's fingers and hands in forging and stamping production and to eliminate work places where labor is connected with unfavorable conditions (elevated temperature, dust and gas pollution and high intensiveness). According to the research conducted by the All-Union Scientific Research Institute of Work Safety [VTsNIIOT], in using robots in operations that are related to hard and very hard work category, the burden of labor is reduced by 1-2 categories.

The expediency of broadest introduction of industrial robots is testified by another not unimportant circumstance. Lately, the prestige of professions connected with monotonous and especially hard manual labor has sharply declined, particularly among the youths. Meanwhile, people precisely of this age group according to their physiological qualities are most preferable for performing this type of work. It is becoming extremely difficult for enterprises to ensure employment of such work places. This has an unfavorable influence on labor organization of workers owing to the difficulties in ensuring it with proper discipline. It seems that a conclusion can be made from this about the need for special calculations in order to appraise the consequences of unstable employment of work places, which can be replaced with automatic manipulators for optimal functioning of production. Obviously, such appraisals with a large grain of truth will make it possible to judge the socioeconomic effectiveness of introducing industrial robots.

Speaking in favor of robotics systems is also the fact that despite all difficulties connected with mastering them, the recovery of this type of equipment is extremely high. Thus, its period for robotics systems which include a first generation industrial robot with a carrying capacity of up to 5 kg does not exceed 2.5-4 years, for a first generation industrial robot with a carrying capacity of up to 50 kg 5-6 years and only in certain cases with a wholesale prices of more than R50,000 more than 6 years.[9] Let us remind that the fixed recovery period for new equipment is determained by the normative efficiency coefficient of capital expenditures E=0.15 and amounts to 6.7 years.

Utilization of automatic manipulators (industrial robots) helps to radically solve the questions of improving the conditions of labor and increasing its productivity. This makes it possible to regard them as an important means for raising the socioeconomic efficiency of production.

FOOTNOTES

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9817
CSO: 1828/95

ECONOMISTS REVIEW BOOK ON AGRICULTURAL MANPOWER

Moscow EKONOMICHESKIYE NAUKI in Russian No 12, Dec 83 pp 106-108

[Review by B. Gershkovich, professor of economic sciences, and Yu. Davydov, doctor of economic sciences of book "Trudovyye resursy sel'skogo khozyaystva. Voprosy teorii i metodologii" [Agricultural Labor Resources; Theoretical and Methodological Questions"] edited by V. N. Ovchinnikov, doctor of economic sciences, Mysl', Moscow, 1982, 115 pages]

[Text] The successful implementation of the socioeconomic development program for the village, worked out by the 26th Party Congress and the May (1982) CPSU Central Committee Plenum, depends to a significant degree on the state of labor resources. This circumstance has been reflected rather widely in recent economic research. Sovkhoz and kolkhoz labor resources and work force questions are treated in the press and in television and radio broadcasts. The attention, however, is usually directed to the reproduction of labor resources, to guaranteeing them to agricultural enterprises; much less is said about the other side of the problem, which in the final analysis is of decisive significance--the interrelationship between agricultural production and the quantity and quality of labor resources. The problems of correspondence between material and human factors in agro-industrial production are still inadequately analyzed. The work under review is attractive primarily because the author assigns paramount significance to these comparatively little studied questions. The urgent questions of the development and interdependence of a special education system and labor resource development in the village are given to special examination in the book.

The monograph is organized so that the most important theoretical questions are examined first, and then problems having direct practical application. Such an approach must be acknowledged as successful. Without diminishing the importance of examining the practical side of labor resource problems, it must be stressed that the study of their quality, quantity and pattern is possible only when based on a firm theoretical foundation, because without that base the solutions to a whole series of practical questions would tend to be framed only within already formed tendencies and proportions which do not always correspond to the agricultural development needs of the country.

The book under review, we are suggesting, marks the first time in economic literature in which questions concerning the essence and features of the

manifestation of the law of correspondence of human and material factors of production in the area of agricultural economics have been investigated so extensively and in such detail. The authors convincingly show the specific effects of this law under conditions of intensifying agro-industrial integration. These effects include the broadening of its influence and the appearance of special requirements for the human factor, caused by new forms of the organization of production and improvements in the material elements in the production forces. The agro-industrial worker should have the high general education and special training to master neighboring professions, to know how to react quickly to changes occuring during the course of the year, to understand not only the proper production of agricultural produce but also the technology of its processing, preservation, etc. One may agree with the authors that at the present time, the worker closest to the concept of the "agro-industrial worker" is the person with secondary specialized agricultural education.

The "quality" of the work force drawn into agricultural industry is an aspect which arouses great interest. The theoretical development of the category in economics, "quality of work force," is known to be clearly inadequate. Furthermore, not all economists recognize the possibility of isolating this category. The demonstration and proof in the analysis, carried out by the authors of the monograph, convinces one not only of the rightness, but of the necessity, of further research into this category.

An investigation into the requirements for the structural elements in the quality of the work force in the agricultural production system--ways of streamlining the labor activity of the village workers--has practical significance. Agro-industrial integration makes it possible to expand the possibilities of using skilled workers, to improve in an essential way the use of aggregate labor time on an annual basis, to overcome the seasonal quality of agricultural labor, to diminish the number engaged directly in agriculture and, correspondingly, to increase the number of workers engaged in branches servicing agriculture, and to improve the qualitative component of labor resources.

The operational experience of a large number of farms combining agricultural activity with the development of industrial production attests to the widely used practice of diverting part of the labor reserves, freed between seasons, from agricultural to industrial production and vice versa. Such a combination leads to a reduction in the total labor power requirements. According to the calculations done by the authors of the monograph, the reduction in the coefficient of seasonality of kolkhoz labor from 11 to 7 percent in conjunction with the development of processing industries at the kolkhozes makes it possible to improve the use of the annual reserve of labor time by 12 percent, and because of this, to increase the annual labor payment by 27 percent (see page 41).

All measures directed toward overcoming the seasonality of labor in agriculture are also factors which accelerate its industrialization. The distinctive traits of industrial labor in general are its mechanization, the clear cut inter-activity division of labor (according to its services) resulting from

mechanical systems; the forms of the intraeconomic organization of production conditioned by the division of labor (specialization, cooperation, combination), and the corresponding methods of organizing the technological processes (line production, rhythm). The indisputable quality of industrialized labor, its express economic advantage, appears as greater productivity. The comprehensive mechanization of agricultural work is the most important condition for further progressive development of the agro-industrial complex. The authors believe that, to realize this goal the equipment allocation of labor must be approximately tripled or quadrupled (see page 44). The urgency and scale of the problems solved during the process of establishing the comprehensive mechanization of agriculture are particularly illustrated by the fact that the proportion of agricultrual workers engaged primarily in semiskilled or unskilled manual labor consists now of approximately 2/3 of all those working. This is 1.5 times greater than the corresponding ratio in manufacturing (see page 50).

Emerging as a factor intensifying the industrial development of the village, agro-industrial integration leads to a progressive structural shift in the occupational division of labor in the village toward an increase in the proportion of skilled workers. The expansion of the list of agricultural occupations due to the agro-industrial synthesis as a result of adding mechanized labor occupations, as the authors correctly point out, has, as one of the most important social consequences, the growth in the sense of people's satisfaction with the possible choices available to those interested in these occupations. Another consequence is the fact that mechanized labor occupations possess greater prestige (greater social significance from the point of view of the one selecting) and stand out as preferable in terms of increasing skills and social professional advancement.

The agricultural-industrial synthesis, which changes the character, content, conditions and results of agricultural labor, assists the growth of its prestige, and thereby causes the work force to be attached to the village, particularly the youth. We note, for example, that the departure rate of people from the sovkhoz-plants of Moldavia is half that from kolkhozes.

The development of village industrialization in combination with a highly developed industrialized agriculture plays an important role in the realization of progressive structural shifts in employment of various types of labor in society as a whole. The relationship of the number of workers engaged in creative intellectual work (specialists with higher education) and groups of persons of the average service staff (with a secondary specialized education), whose work is also primarily mental, should, in the short run, in the opinion expressed in the work under review, be changed from a ratio of 1:1 to 1:4. At the same time, substantial shifts will occur in the structure of the employment of primarily manual labor. The proportion of workers in mechanized labor will approximately double, reaching 80-90 percent. As to keeping a small group of people employed as manual laborers, this is unrelated to the residue of unskilled, simple manual labor. Something else is meant here--keeping highly skilled groups of manual laborers for setting up and repairing automatic and fully mechanized production lines (see page 55).

As the analysis developed in the work under review shows, agro-industrial integration not only necessitates an increase in the general level of educational and vocational qualifications of rural workers, but also creates definite conditions for fulfilling this necessity. The increase in the amount of free time available to workers in agro-industrial enterprises attests to this, as well as the improvement in structuring its use to increase the cultural and educational level.

The role of specialized education in forming rural labor resources is assigned a significant place in the book. On the basis of broad factual material, the authors give an analysis for providing the RSFSR with skilled personnel; they show specific directions for improving the quantity, quality and personnel pattern in the village.

In the work's concluding chapter, more long-range trends for improving the system of training mid-level specialists for agro-industrial production are discussed. The authors concentrated upon those aspects of improving the personnel training systems which developed in conjunction with the scientific-technological revolution.

Of course, in a short review it is impossible to consider all the questions examined in the book. We note, however, that a number of the author's judgments seem disputable to us. This relates primarily to questions linked with the law of correspondence of human and material factors of production, as well as with the concept, "quality of the work force." The research, in our view, would be improved if certain positions, particularly in the last (fourth) chapter, were presented in a detailed manner rather than theoretically. Thus, the authors, having devoted particular attention to mid-level personnel, at the same time treat the problems of the upper ranks and mass occupations only in general terms, although the book is oriented toward researching rural labor resources as a whole. The trends in the relationships between mid-level personnel and the mass occupations remain outside the author's scope, even though this is one of the important elements in the nature of the work force. The analysis of the advantages of the new form of training mid-level personnel through the sovkhoz technical schools is done only theoretically, without factual basis.

In our view, the work would be improved if the authors explored more extensively the problem identified by them as the shaping of the agro-industrial worker under the influence of the law of transformation of labor under conditions of agro-industrial integration. We are suggesting that the authors have not yet succeeded in finding the essential mechanism for transferring the requirements of the law of correspondence of human and material production factors to the system for training mid-level personnel, since certain elements of this mechanism are analyzed at the theoretical, but not the functional level.

The book presents the interesting idea of the possible quantitative comparative evaluation of the development level of economic regions, but in the practical section in determining the prospective needs in mid-level personnel, this idea is used only indirectly.

In conclusion, we note that the monograph contains many practical conclusions and proposals. We have already discussed several of them here. We would like, further, to point out the valuable suggestion of creating an automated system of tracking the level of agrarian industrial development in individual regions of the country. This system could serve as the basis of a quick analysis of the state of affairs in agricultural production, for developing a scientifically founded specialization for various economic regions; it could help the planning agencies in guaranteeing organically unified material and human factors of production. A number of the author's suggestions have already found application in the practical activity of the agricultural technical schools.

This book is well edited, interesting to read, and will be useful to all those interested in labor resource questions in the agrarian sphere of production.

12318
CSO: 1828/90

DIRECTION, QUALITY OF ENGINEER TRAINING DEBATED

Engineer Training Problems Discussed

Moscow IZVESTIYA in Russian 11 May 83 p 3

[Round table discussion conducted by B. Koltovoy, E. Maksimova, and I. Prelovskaya: "From Student to Engineer"]

[Text] From a plastic children's toy to a walking excavator, from a prefabricated panel-board house to a space rocket -- all this is the fruit of engineering thought. There is no need to prove the importance of this profession, the more so today when scientific-technical progress makes the engineer the key figure combining science and production.

Engineer training is being carried on intensively in our country. In the 30 years from the 1950's to the 1980's their number has risen from 400,000 to 5 million. But here we posed the question to several plant managers: do they have enough engineers at their enterprises? Their response was: what kind of engineers? There are enough people with diplomas, but there is a shortage of thinking engineers who know how to make decisions and manage things.

There are arguments going on about the engineer problem. Why are the results of engineering labor not always adequate? Why is competition for admission to technical VUZes declining? Is the profession's prestige dropping? How are mistakes in distribution to be explained?

Improving the quality of engineering work is an important reserve for the economy. Nonetheless, there are many facets of this problem, and we decided to begin the discussion with a "round table" conversation. The next one will be on conditions which stimulate or impede the activism of the engineer in production.

Specialists who had already raised the question of engineer training in their articles and books were invited to take part in the first round table discussion. They were G. Balandin, department head at the Moscow Higher Technical School imeni Bauman; I. Belyakov, rector

of the Moscow Aviation Institute; L. Vladimirov, Kirovograd Institute of Agricultural Machine Building professor; A. Grigor'yev, department head at the Leningrad Polytechnical Institute; D. Zyuzin, candidate of economic sciences and sociologist; V. Kiryukhin, chief designer of the Kaluga Turbine Plant; A. Kochergin, head of the department of philosophy of the Siberian Department of the USSR Academy of Sciences; V. Molchaninov, chairman of the council of young specialists of the Moskvich Production Association; A. Radov, candidate of philosophical sciences; D. Rostovtsev, rector of the Leningrad Ship Building Institute; N. Strel'chuk, rector of the Moscow Construction Engineering Institute; V. Tyrchenko, doctor of philosophical sciences; and V. Finkel', department head at the Rostov Higher Technical School-Plant.

The Prestige of the Diploma

[Question] Does the engineering profession have prestige?

[Answer, V. Kiryukhin] The children of our best workers and leading engineers come to us in the design bureau after graduation from VUZes. Many have completed correspondence or evening courses. Does this mean it is prestigious to be an engineer? When an engineer is working on technical progress by the sweat of his brow, he feels his contribution -- this is the most prestigious pursuit there is. Who could contradict this? Isn't the point that bureaucratic red tape finds its way into engineering work and the documentation system is needlessly complicated. We try to protect young designers, guide them through production, hold contests for the best development work, and help them prove themselves.

Of course, wages are an important consideration. Those who are good, who have studied with persistence and desire and have received "red" diplomas, must be paid more. Both graduates and engineers themselves must be differentiated by classes in the design bureau. The person who works on new technology generates new ideas and should earn more. Material incentive for intelligence and talent increases respect for the profession.

[Answer, I. Belyakov] The attraction for certain groups of professions has never been stable. There are various reasons for this: feeling for what is the current "hot spot," future earnings, and possibilities for growth. In the 1950's energy was especially popular, and in the 1960's it was nuclear physics. Now there is high competition in economic, medical, and trade VUZes. It would be more correct to talk less about the engineering specialty's losing prestige, and more of how the popularity of other specialties has risen.

It is also difficult to compare technical VUZes themselves. There are institutes which have enormous scientific potential and famous schools and are very well equipped. And there are those where the whole teaching staff has only a few docents and not one doctor of sciences, while the material facilities are poorer than at a tekhnikum. It is difficult for these institutes to train engineers with a long-range perspective.

Our VUZ has no complaints about the level of graduates. The question, if it arises, concerns not training, but utilization.

[Answer, V. Molchaninov] I graduated from the Moscow Auto Mechanics Institute. I was trained to be a designer. But it turned out that many of those who studied with us were not needed in production. At the same time the VUZ does not teach the psychological foundations of work with the collective. A young designer is attracted to the shop by higher wages, but he is compelled there to work in a different speciality than the one for which he was trained at the VUZ. My opinion is that engineer training should be more differentiated. Some should be trained to be managers and they should begin as shop foremen, while those who receive designer and researcher diplomas should be sent to the design bureaus and laboratories.

[Answer, L. Vladimirov] We must train both, engineers for broad management work and engineers for applied technical work.

[Answer, D. Rostovtsev] Unused knowledge is a moral loss for both the state and the individual. But what is an engineer? Everyone has his own idea of this concept. Here the necessity of forming creative engineers was talked about. Of course, we need creative people. But can everyone in a mass profession be creative? In reality the person who is obsessed with engineering ideas and can renounce all else to see them realized is a rarity. The engineer is a developer, an organizer, a competent man in his field who can bring the ideas of the creator into being. This is really a good engineer.

[Answer, A. Radov] The nature of sectorial requirements for engineering are inevitably reflected in the nature of requirements of the VUZ student. The person who makes the order determines the quality of the product -- what he asks for is what he receives.

The time has passed when engineering VUZes took the "cream of the crop" and selected the best school graduates. The school graduates coming to technical VTUZes today are average and good students, but usually not the best ones.

[Answer, A. Grigor'yev] Our institute is one of the most respected ones. Basically, it is a technical university. However, I cannot say that the problem of shaping the student body does not worry us. Competition for Leningrad technical VUZes today is not too great: 1.6-1.8 applicants per position. And the point here is not even that the graduating students who interest us are bursting to go into the humanities. A whole ring of polytechnical institutes has been formed around Leningrad. Now, most likely, there is no sense discussing whether such growth was justified, but as a result the possibilities of strong VUZes are not being used to the fullest extent.

[Answer, N. Strel'chuk] We are not so rich that we can split up and scatter our opportunities. In order to create a strong teaching staff and "accumulate" scientific, conditions, capital, and time are needed. Is it not proper, as industry is doing, to follow the course of strengthening existing VUZes rather than investing in more new ones?

[Question] Obviously, the answer to this question is directly related to the need for specialists, to accurate calculation of the need for them in sectors and regions in the near and more distant future, and to consideration of the development of production forces.

How Many Specialists Are Needed?

[Answer, G. Balandin] Various specialists work in a contemporary enterprise: economists and chemists, mathematicians and programmers, sociologists and psychologists. With further modernization of production and development of a management system the need for diverse specialists will increase. Does this mean, however, that the need for engineers in particular will rise even further, if this concept means what it has meant for a long time now? Is it necessary to produce more and more of them?

[Answer, V. Turchenko] Twenty years ago the goal was set: for every engineer there would be 3-4 technicians. But the ratio has changed in the opposite direction. Tekhnikums are increasingly training skilled workers. According to sample surveys, one out of every three technicians in industry performs the duties of a worker. Now engineers are also being used in worker positions. In my opinion, an unplanned restoration of the proportions objectively necessary to today's economy is taking place. I think that technical progress dictates the necessity of continuously expanding the set of workers who have the skills of technicians and engineers. A new type of worker is on the agenda, one who will be able to perform the duties of both a worker and a specialist.

[Answer, D. Zyuzin] Are professional differences between the labor of an engineer and a worker disappearing today, then? Aren't we in a hurry to simplify reality? It is thought that worker occupations are becoming more complex. But engineering ones are not?

Confusion has arisen with the very concept of "engineer." We may call many people engineers -- controllers and supply workers, landscapers and clerks. People who are engaged in work which a school graduate could handle after a short period of on-the-job training are included in the roster of engineers. Meanwhile, engineering labor in its genuine meaning today demands not only deep knowledge, but also a certain level of thinking. In other words, it demands quite complex training.

How should positions which require higher technical education be defined? At the present time this is done simply -- the existing situation is copied. Those positions in which the overwhelming majority of engineers work are those considered to require engineering education. But after all, engineering education is not actually needed in all these positions. During the 10th Five-Year Plan the number of engineers increased by 1.5 million. Must production of them be increased further?

[Question] Higher education is supposed to admit as many first-year students as production requires engineers. But on what basis does production require them? Requests from enterprises -- that is the basis for the admission plan. These requests, however, are often overstated: in some places people are used outside their specializations and skills, and in other places they may compensate for labor turnover. The admission plan of this launching pad of higher education is not based on the technical structure of production nor on the future of its development, but rather on the achieved level: the number of vacant positions, plus an increase and a reserve "for a rainy day." Is there a surplus of engineers or, on the contrary, a shortage? How many of them are

needed by the ministry and the enterprise? It is difficult to answer. In contemporary conditions the danger of miscalculations in planning and the difficulty of maneuvering are growing. Scientifically substantiated methods for determining the requirements for specialists are urgently needed.

Many participants in the round table discussion mentioned the sensitive problem of screening, which has been waiting a long time for a solution. Professor Grigor'yev cited the average indicators for Leningrad, where one fourth of the people who enroll in the first year of study are unable to complete their education in the scheduled time. Every VUZ has its own figures and percentages. But all of them have an equal need to rid themselves of indifferent students. In every VUZ they will show you examples of how these students hold on until graduation. As a result industry receives poor, indifferent specialists.

[Answer, V. Finkel'] The struggle to keep students at any price hinders raising the quality of the product of higher education and essentially works against the normal demands which a teacher is obligated to make of a student. Evaluating a response with a well-deserved "two" becomes dangerous to the teacher's own job.

From the Standpoint of the Future

[Question] The level of an engineer is the product of all its components: selection and utilization of teachers; a sensitive and demanding attitude toward their labor; provision of laboratories;organization of practical training, and so forth. Outlining the range of knowledge and projecting it on production necessity -- everything begins with this.

[Answer, A. Grigor'yev] The number of specializations and specialities is being increased without adequate reason. They pile one on top another, often as a result of the activities of a particular "over-achiever." The departmental principle is spreading to our education base of operations. Almost every ministry trains engineers in its VUZes for the very same specialities -- for themselves. Welder-mechanic and welder-metallurgical worker, foundry worker-mechanic and foundry worker-metallurgical worker.

[Answer, L. Vladimirov] I remember, those specializations appeared a very long time ago because two professors of the first specialization and two of the second lived in Leningrad. As a result we train metallurgical workers and mechanics, while foundry worker-technologists are needed most of all and there is no such specialization.

The criteria by which we teach are cumbersome and awkward. The plan has a very small reserve -- 132 hours -- which the VUZ council is free to maneuver with. But more and more new disciplines are being introduced. Where do the hours come from? They say: from the reserve. But it was long ago exhausted. Then how are we so clever? Innovations occur at the expense of the profile disciplines which make the engineer a professional. And here is the result: these subjects comprise less than 10 percent of the total study time allocated for all VUZ education. We will confess: even if a student wants to examine all subjects in depth and do everything required, he will be physically unable to do so.

[Question] If a student wants ... There are such students, many of them. They burn with a desire to take as much knowledge and as many ideas as possible from the VUZ and their teachers, and prove themselves in science under the supervision of teachers.

[Answer, G. Balandin] Contemporary higher technical education is designed, unfortunately, for the average student. The orientation to mediocrity makes the learning process less creative, and creative young people to not want to accept this.

[Question] At the round table discussion Professor Balandin cited a "memorandum of academically successful students," with this epigraph from Goethe: "And that which is called the spirit of the time is the spirit of the professors and their ideas." The memorandum contains a request that the department set up a creative seminar. The future engineers write: "We know that today as never before the ability to think and act creatively is needed. We want to master the spirit of the time and not miss out on new directions in science, engineering, and technology." The statement also contains these words: "We are convinced that the teacher is the catalyst in the formation of the creative engineering personality."

We emphasize: good students need attention no less than poor ones (at the present time those students who are dragging down the various overall indicators of the VUZ take more teachers' time than good students). And secondly, in addition to knowledge, the teacher must have the ability to motivate.

[Answer, G. Balandin] Nonetheless, more and more young people who have not mastered pedagogical skills are rising into the departments today. The regulations of the Moscow Higher Technical School imeni Bauman used to recommend strongly that only those "revealing the gift of teaching" be kept for work at the school. It is an almost forgotten rule.

Teaching has long been considered akin to an art. But now there is a trend toward petty regulation of teachers' work, and this sometimes replaces high standards.

[Answer, L. Vladimirov] The matter has come to the point where it is proposed that each one of us make up a technological chart for each type of studies which shows the number of minutes used for each question. And a logical design diagram for each discipline! And programs for each type of practical training -- specific and comprehensive! There are already special instructions of many pages on how to set them up.

[Answer, N. Strel'chuk] The organization of the learning process contradicts the tasks which the scientific-technical revolution poses for engineering education. After all, it should accurately and efficiently discern changes in engineering, continuously take the achievements of science and its future into account, and develop at a fast rate.

[Question] This development demands a definite base of instruction. The unanimous opinion of the participants of the conference: from the point of view of

contemporary technology, many VUZes are poorly equipped. Industrial enterprises have the right to give equipment to VUZes, while the ministries may allocate a certain percentage of their capital for VUZ development. Nonetheless, it is a right, not a duty, and so everything depends on the will and desire of the particular manager.

[Answer, I. Belyakov] The sector should be obliged, and I mean obliged, to take care of the base on which its engineers are trained.

[Answer, A. Kochergin] The problem we are discussing is a social one, with many aspects. An engineer is both an organizer of production and an educator. His narrowness can turn out to be an obstruction in the path of scientific-technical progress.

While knowing what has to be done, an engineer does not always know how to find ways to get out of difficult situations. The thinking of the future engineer should be shaped, and he must be taught methodology. And from this point of view it is important to give the most fixed attention to teaching the social sciences. A philosophy teacher must converse with the student in just one language -- the language of his specialty. What should become an internal conviction must never be superficially proclaimed.

Under contemporary conditions the role of regulation and external compulsion is lessening the role of internal compulsion -- the conscience. On the engineering level too. An engineer is expected to have his own approach to the work. He must know how to create a favorable human climate in production. This means from the start he must be taught to take responsibility personally and should be put in situations which require making decisions.

[Answer, V. Finkel'] When beginning work in production the young engineer will either silently adopt the level of the section as he finds it and will, without thinking, settle into drudgery or, inspired by high ideas, he will start to study how to improve the work.

Our pupils are becoming heads of worker collectives in which people with secondary education now predominate. Healthy work relations between these workers and the engineer should be based on mutual respect, trust, and interest. High sophistication and purposefulness in the manager promotes this. Engineers enrich the body of the country's intelligentsia and as such are responsible for a great deal more than just their technical functions. Do VUZ programs take this into account? Are we concerned with the range of vision of teachers whose intelligence and spirituality are self-acting pedagogical instruments?

A good lecture is not just a lesson with proof of a theorem and laws and the enumeration of All-Union State Standards but, if you will, a high-altitude flight from which it is possible to "dive" at any applied target. Unfortunately, these categories -- sophistication and erudition -- do not even figure in the list of general requirements when teachers are selected by competition.

It seems to me that the practices used in conferring the learned titles of docent and professor must be reviewed. We must not be satisfied with documents that are submitted by VUZes; the higher degree commission must always hear

lectures by the applicant for the learned title. A higher level of lecturers needs to be introduced. And the rector and prorector must always give lectures and teach an advanced class. Only a working teacher can competently and properly manage a VUZ.

[Question] Participants in the round table discussion touched on many problems which disturb the public, but all the statements were permeated by one main thought: the accent in training specialists must be transferred to quality. And this leads to the necessity of raising demands for all facets of instruction and indoctrination. Given the large scale of training licensed specialists, the high concentration of them in the national economy, and the current limitations of labor resources, it is important to accurately and with substantiation picture which people and how many of them must be trained, and where and how, in accordance with the actual needs of production and the trends of its progressive development.

The fundamental questions raised by the participants in the round table discussion deal with many organizations and departments, but above all they relate to the USSR Ministry of Higher and Secondary Specialized Education. It is important that readers know what practical steps are being taken based on statements in the press, and which aspects of the activity of higher education are being reviewed, analyzed, and improved. Professor Grigor'yev expressed the general mood when he said: we all want to believe, when we are referring to the VUZ, that there are no insoluble problems.

Problems of Engineering Profession

Moscow IZVESTIYA in Russian 2 Dec 83 p 2

[Article by V. Soldatenko, chief engineer at the Kvant Scientific-Production Association: "The Engineer Should Be a Creator -- The Facets of Responsibility" -- see also IZVESTIYA article of 11 Nov 82, p 2, published in USSR REPORT: HUMAN RESOURCES, JPRS UHR-84-002 24 Jan 84, p 64]

[Text] IZVESTIYA has begun a conversation about how an engineer should be a creator with two round table discussions (Nos 130/131 and 314/315 for 1983). Many true words were spoken about the objective reasons which prevent him from being a creator. But I think that this is, to a great extent, the engineer's personal problem.

The need for engineering personnel exceeds the supply everywhere. After graduation from an institute it is not difficult to remain in the same large center where one studied. It seems to the young engineer that he is lucky if he takes advantage of this opportunity. But now suppose job placement has been done according to the "lucky" variant. The engineer arrives at the plant. In a large industrial center there will be established enterprises and established staffs. Receiving access to independent work and opportunities for advancement is difficult. Years pass. Youthful enthusiasm fades, transfers from one plant to another begin, and a feeling of bearing a grudge against someone emerges. It seems that the cult of large centers is one of the reasons for undeveloped engineering destinies.

It is very important that an engineer begin labor activity at a new plant or on a new problem. If only because any manager most likely would prefer an experienced engineer over a young one when selecting specialists to solve a serious challenge and having the opportunity to choose. It is another matter if the only choice is a young specialist. But this is the case for a new enterprise.

What is needed so that a beginning engineer would dare to select a work place far from home? Based on personal experience(I worked in Siberia for almost 18 years; I went in 1959 after graduating from the Kiev Polytechnical Institute),I will express my reasons.

It is necessary that USSR Gosplan place young specialists in Eastern rayons of the country in quantities which fully satisfy the requirements of these areas for licensed engineers. Let us suppose that more opportunities emerged for a young specialist to receive an appointment which guaranteed a happy engineering destiny. What then needs to be done so that he will take advantage of this opportunity (and not only for three years)?

It is essential that he know at this moment that there will be no problems later, having worked for a while, if he nonetheless decides to return to the place where he lived before the institute, and with his family if one has appeared by then. Also for the first 5-6 years, the expenses of the young specialist and his family for travel during vacation must be paid. These problems, if they are not solved, will put the young engineer in a position with unequal rights relative to his colleague who remained working in the European part of the country. Inevitably a lingering feeling of separation from the customary, close world in which he grew up will arise within him. And it is precisely this feeling which frequently forces an engineer who has already accumulated experience to pack up his suitcases.

Finally, regardless of the geographic location of the developing enterprises, there is the problem of housing. We have already drawn the correct conclusion that such projects as Pioneer camps and plant dispensaries must be included in the estimate for industrial construction. Adopting such a decision is also necessary in regard to dormitories and apartment houses for engineers who are sent to enterprises after graduation.

We remember the high social qualification of the engineering profession when we carefully select candidates for instruction and train future specialists, and then we systematically place them after graduation. At these stages we are aware that this professional group, whose labor efficiency determines the level of development of many key spheres of material production, is formed at the price of significant expenditures. And then it is that the unplanned element enters.

I do not recall finding in the structures of management organs, subdivisions which supervised the use of engineering personnel (not management personnel -- there are such subdivisions in every department, I mean engineering branches). Having taken specialists from a higher school in an organized manner, we entrust them to chance from then on.

Today a significant number of engineering positions are occupied by people who do not have engineering diplomas but who conscientiously perform the duties of the position. Although personnel offices are endeavoring to increase the "percentage" of licensed specialists, the time to refrain from using workers with practical training has not yet arrived (and it is unlikely that the time will come -- there is, after all, the concept of "talent").

But the time has come to remove the word "engineer" from designations of all positions which exist in the national economy (of course, if it is included in these designations). In the first place, engineer is not a position but a qualification. And in the second place, in the contemporary stage of the development of all brances of technology, the qualitative changes in them are so rapid that only specialists who have had special training can keep pace with them. There is no other way. It is precisely for this reason that the USSR State Committee for Labor and Social Problems ought to be convinced not to use the term "engineer" to define functions which a skilled worker can perform.

The concept "engineer" should be removed from the "table of ranks" primarily in the interests of the specialists themselves. It will be unnecessary for a plant director to keep an engineer in a position whose designation includes the word "engineer" if an employee with another level of training is adequate. And an engineer will not be resistant to begin his labor path with work, let us say, repairing machine-tools with digital programmed control, understanding that this is an essential stage for him, when abstract concepts assimilated in lectures acquire concrete meaning. He will not be embarrassed by the fact that he is a licensed specialist in a worker position, while a skilled worker is in an engineering position. I think it is precisely the present "table of ranks" that has prevented dissemination of the know-how of metallurgical workers, who begin "breaking in" engineers in worker positions, to many sectors of industry.

Several years ago IZVESTIYA published an article by A. Shokin, the minister of electronics industry, on the stages of professional growth of an engineer. At that time the theme was not developed. But it is a pity. Life itself confirms its timeliness. After all, cases are well-known where learned degrees were awarded for epoch-making engineering results without defending a dissertation.

The scientist's product is an article in a scientific journal. The product of an engineer is a plant, a machine, a bridge, new technology. We then, trying to gage both categories by one measure, compel a good scientist to squander his time in order to become a poor engineer (after all he must also "introduce himself"!) while we compel a good engineer to become a poor scientist (after all he must defend his dissertation!).

Obviously the point is that in practice the functions of the two professional groups -- scientists and engineers are merging today. A scientist's work "field" lies at the point where our knowledge ends. This professional group is responsible for the rate of incorporation of new sections of its work "field" and for accelerating scientific-technical progress on this basis. In what form should a scientist produce a result? In the form which has been developed by the whole history of science -- in the form of a scientific report of new knowledge gained.

The engineer's work "field" lies in sections of knowledge already conquered by scientists. But, laying claim to a higher level of public recognition, an engineer is forced to follow a procedure of obtaining degrees and knowledge which was developed by science for scientists. Why? Obviously, there is no sense in an engineer either using a "foreign" system, or in insisting on its simplification. For him a similar prestigious system is needed, but one that is his own. And his own procedures, since technical projects are always real and tangible. It seems that the question of introducing degrees for engineers and developing the appropriate procedures has also matured.

A review of the whole combination of moral and material incentives for engineers should be strongly correlated with solving the most important national economic challenges. It should help concentrate engineering personnel primarily on rapid incorporation of the production capacities of newly built plants, on rapid and efficient reconstruction and technical re-equipping of crucial enterprises of our industry, and on developing production of highly efficient means of production. In light of this, any particular system of moral and material incentives should be introduced not in general, but only to fit practical programs and for actual participants in its implementation and only after labor economists are able to offer a model of its application which merits confidence (this, by the way, is also a most important challenge).

A great deal of freedom can and should be allowed in applying effective systems of moral and material incentives to specialists in manufacturing industry for results of their activities which insure actual export of their products into the world market, that is, for creating and producing competitive articles.

And of course, political mobilization of the country's engineers to increase the rate of development of the economy and raise its efficiency, and to promote victories of the socialist economic system in the world economic competition with capitalism, is very important.

People talk about the fear of responsibility as one of the reasons that engineers sometimes retreat to lathes. I think that fear of responsibility is not the point here. Can one imagine a surgeon operating on a patient and a telephone is placed in front of the operating table; every minute when it rings he is supposed to receive new assignments and give new information? Apparently it has not yet come to that. But today an engineer often finds himself in such a position.

It would seem that in a planned economy, the plan established for the current period should be the basis of everything. Contact with "above" should occur only on the basis of plans. And nonetheless, it is precisely "from above" that streams of unplanned paperwork pour. The best work hours are spent fulfilling assignments, directives, and demands contained in them. We once calculated that in the last five years the stream of papers from higher economic organizations has doubled.

What then is the basis of this phenomenon? Inadequately skillful management of planning in sectors, and often the lack of fundamental self-restraint also. People who have come to management positions in economic organs without being "broken in" in worker collectives and without adequate professional experience

are making important small contributions here. It is particularly natural for this category of managers to be afraid of every little thing and to send "down" heaps of unplanned "insurance" papers.

Conditions in which an engineer labors need to be normalized. And in order to do this we must carry on an unrelenting battle against unplanned "paper" activity. This may be done, for example, in this way: any documents besides standard plan and report documents should be filled out only on official paper with high stamp taxes when higher economic organs contact enterprises, so that the generation of "insurance" paper will be sharply limited.

I am sure that if we regulate the utilization of engineers and in organizing their work remember why society "thought them up", retreats to the lathe will be fewer.

The conversation which took place at IZVESTIYA's round table discussion began with words, which are crucial for the problem under discussion, from Comrade Yu. V. Andropov's speech at the June 1983 Plenum of the CPSU Central Committee: "Unified scientific-technical policies take on conclusive significance today. Enormous work on building machines, mechanisms, and technology for both today and tomorrow await us." These are remarkable words! And it is precisely in this cause that we must not delay even for an hour the work of mobilizing engineers to meet these challenges.

Improve Quality of Engineers

Moscow IZVESTIYA in Russian 10 Jan 84 p 2

[Article by V. Anokhin, engineer, under the rubric, "An Engineer Should Be A Creator : Talents Without Admirers"]

[Text] At a certain point in time certain problems acquire especially great significance for the life of the country. Today the task of increasing the efficiency of the labor of engineers is becoming exceptionally important. In my opinion, this is one of the key problems of scientific-technical progress. IZVESTIYA published a number of interesting materials under the rubric "An Engineer Should Be A Creator." It seems to me that very timely questions are raised in the conversation B. Konovalov had with Vladimir Pavlovich Kabaidze, director of the Ivanovo Machine Tool Building Association, "From Each According To His Talent."

Why is the prestige of the engineering profession declining? Why do only an insignificant number of engineers do the lion's share of all the work? Why is the salary of a skilled engineer lower than the wages of a good worker? The answers to these and many other "why's" would help reveal enormous reserves of our economy.

And these answers (at least for some of the questions posed) can be found if the process of training, assigning, and utilizing engineering personnel is analyzed. The essence of the matter is simple: a significant share of the engineers we have, in my opinion, should not be engineers.

Simple calculation shows what a heavy burden for the state an engineer who turned out to be an average student proves to be. By graduating such an engineer, the state turns out to be a loser three times. In the first place, it invested a lot in his instruction; secondly, it lost many much-needed working hands; and thirdly, it is compelled to pay a salary to him for life for labor which is by no means engineering labor.

Quite often it may be seen that a whole subdivision of 15-20 engineers rack their brains over a problem which one or two good specialists could solve. They spend most work time repeatedly exchanging information on the problem under study, but even more they waste time exchanging information which is far from the subject. But after all this group of people must also be managed, and this matter is very troublesome. Naturally, the task of managing this collective takes precedence over solving the problem posed. As for the work. . the work may be postponed for a month, a quarter, a year. And the more complicated the problem, the more unproductive expenditures and the lower the efficiency of engineering labor.

In any creative work one rule operates, which may be simplified and expressed in this way: it is better to order an opera from one composer than from a dozen performers. So why then is the engineering sphere not managed by this rule?

About 30 years ago, one could hear: "He did not graduate from an institute, but he has a head on his shoulders." Today, in contrast, it is more often said: "What use is it that he graduated from an institute; he is still a loafer." Popular wisdom says, "One must reap as one has sown." But we have sown neglect of a basic principle of socialism: "From each according to his ability, to each according to his labor." And we have forgotten both the first part of it and the second. After all, the formula of this principle, or more precisely, the algorithm of its application, is simple. We must determine the abilities of this "each", establish conditions for their appropriate application, and demand that they be realized in labor and justly paid.

Despite the simplicity of this algorithm, it is hard to find even one link engaged in training or utilizing engineering personnel which is even partially guided by it. Is it difficult to apply them in life? No. As far as determining abilities of a future or present engineer, this is no trouble at all -- his intellectual potential is reflected in documents such as the high-school diploma, personal work records, and in files. But the whole point is that we are simply closing our eyes to these abilities. We want absolutely everyone to be the same, made according to the All-Union State Standard.

We have been talking a great deal about the harm of wage leveling in distributing benefits. An approach which measures the creative abilities of a person as equal is no less harmful. I remember often and with deep gratitude my school mathematics teacher. He did not begrudge giving two assignments in class -- one for most of the students, and one of increased difficulty for a few people. And, imagine, such a general spirit of competition and of creativity prevailed in the classes of this absent-minded old man that no one dreamed of doing anything else.

Let us try to figure out where the disparity between these natural and obvious principles and actual life is actually taking place. Primarily in the system of school instruction where indifferent pupils receive average grades to benefit the school's indicators. Quite a lot has been said about the far-reaching consequences of this negative phenomenon. Students with these "indulgent" average grades are admitted to evening, correspondence, and now even day-time VUZes. This is yet another source of our troubles. After all the pupil and later VUZ student who receives "C's" is a "Trojan horse" who undermines education from within.

VUZ graduates arrive at an enterprise. Here an exemplary student and a "C" student are equal -- they receive the same salary and are assigned to the same work. And no one will take an interest in the creative potential of the young specialists. Yet there surely is a criterion for evaluating this potential -- an extract from the diploma, which is given out to be kept in the specialist's personal file and serves as an important description of him. Why then is this forgotten?

By establishing "discrepancies" in the initial salary of a young specialist of just 20-30 rubles, we would acquire a powerful lever which would stimulate study. The lack of responsibility which exists harms both study and production. It is no secret that talented people often do not immediately find themselves in a new collective, while the adaptable ones (most of whom are "C" students) get their bearings more quickly and promptly take advantage of the promissory note given to them.

In the theory of optimal management, and it encompasses socio-economic problems also, one of the basic elements is choosing the criterion of optimality. An incorrect choice can give results which are exactly the opposite of what is desired. We have an obvious example of this in the management of graduating engineers. Having set the goal of increasing the number of engineers, we moved so vigorously that now it is clear to everyone that something is wrong. And the point is that another important criterion of any kind of management -- the quality of "output" -- was overlooked here. Quantitative growth came about as a result of first lowering the requirements for instruction, then for admitting students, then for teachers, and so on. And as in any complex system, a chain reaction of deteriorating quality began.

There is one other example of the importance of choosing a criterion. Today every manager tries to increase the number of subordinates by any means -- this is the basis for increasing position and salary. And for him it is not important who these people are, what they are capable of, whether he be able to manage them, and whether he provide them all with work; the important thing is quantity. The answer to the question is hidden here: for whom is inflation of the engineering staff advantageous? This defective system demoralizes engineering personnel. Now a sensible engineer tries to become manager. And having become one, he stops being engineer since he lacks a real opportunity to devote himself to creativity. The system of payment for labor should be flexible. The current salary of an engineer, as for a manager, should be calculated based on the volume of work performed and should take into account each person's contribution to this work.

It is well-known in engineering that systems without feedback are inoperable. This is fully applicable to life also. If a person can work, and work more and better than his neighbor, and the evaluation of his labor is the same, then we can be sure that he will not continue to improve his work. And if he still wants to work, most likely he will try to find another position suitable for this. On the other hand, a person who is not capable of creative work, is glad to "create and take risks," but unfortunately. . . Consequently, he is compelled in fact to do nothing, while displaying that we have not yet learned to measure creative labor. But it is not necessary to measure it. It is only necessary to select people who are capable of creativity and create the appropriate working atmosphere for them. Then the question of management and discipline will become superfluous of itself, since a person absorbed in a creative impulse works at the limits of his capabilities.

In my opinion, a "C" student does not have the right to an engineer's diploma. But inasmuch as we already have millions of such engineers for these and other reasons, the problem must be solved based on reality. Now the process of restocking the engineering profession with mediocre engineers has taken the form of a progressive illness which literally afflicts all engineering and even scientific levels. Surgical intervention is the only fundamental way of treating this illness.

The attack on the problem must be carried out on a wide front, beginning with the school and VUZ and ending with production and the institutes. Our socialist principles must be used more effectively as economic levers; we must strip mediocrity of its advantages and open the way for talented people.

Solomentsev on Future Requirements

Moscow SOVETSKAYA ROSSIYA in Russian 11 Dec 83 p 2

[Interview with Yu. M. Solomentsev, doctor of technical sciences, professor, winner of the Lenin Prize, and rector of the Moscow Machine-Tool and Instrument Institute, by A. Glovatskiy; date and place unspecified]

[Text] [Question] Yuriy Mikhailovich, what requirements are being advanced today for the process of training a specialist who will be working in the next century?

[Answer] The engineer of the 21st Century is primarily a specialist who is able to solve major problems and not only the tasks of the moment. Therefore, the whole process of instruction in the VUZ must be carried out taking his future activity into account. Recently the party and government outlined a program for accelerating scientific-technical progress. In order to successfully put it in practice, it is essential to produce the appropriate specialists of different specialties and specializations, unified nonetheless, with standard programmed instruction. Such "landing forces," put into battle against problems could, in my belief, quickly and skillfully accomplish the assigned missions, respond flexibly to a change in production conditions, and in addition sharply decrease expenditures of development, study, and introduction of the results obtained.

Based on this, basic training of the future specialist should be the main innovation in the instruction process. This should be understood as teaching the student the general methodological approach to creating new processes and machines. Mastering them, the specialist will be universal -- he will be able to adapt smoothly to meet other challenges related to the given problem.

We should, if you will, firmly squeeze out information "from our grandfathers" in curricula, despite its importance, and give students a new range of knowledge which will be essential in the future for the new type of engineer. Such an approach will differ essentially from the way instruction is carried out in technical VUZes at the present time. Today it is primarily, as a rule, a set of disciplines based on traditionally set lists. In many VUZes little concern is shown as to whether they are of benefit to the specialist.

And this is not all. The feeling of the necessity of continuous self-improvement and self-education must be begun to be indoctrinated in a young person, beginning during one's school days and intensifying in the VUZ. Without the development of these qualities, even the new type of engineer, under conditions of the enormous volume of information will simply age quickly. Not in years, but in knowledge.

Today the contemporary engineer must function in conditions of an enormous volume of technical information. It is impossible for the specialist to not only digest, but also keep track of the information avalanche. Meanwhile the incompleteness of informational support today already diminishes the technical capabilities of the engineer. And what about tomorrow? This work will be inconceivable without assimilating an even larger volume of information. Specialists confirm that while today this volume is doubling every 1-1.5 decades, by the year 2000 such an accumulation will occur every 1-1.5 years. This means that the activity of an engineer of the early 21st Century will be impossible without using the computer.

And not only for an engineer. According to the prognosis of scientists, by the year 2000 the whole population of the country,beginning from school age, will be involved in dealing with computers. And this process will be just as common as instruction in reading and writing.

In order to use computers efficiently, new systems of automated data collection, storage, and processing will be developed. Tomorrow's engineer must not only know how to use the systems, but also be able to create new informational resources for our country. To be able to propose and solve problems of mathematical modeling and analysis of new technologies for tracking down progressive technical solutions. And not simply progressive but on a level which exceeds the world's best achievements.

He will have to master the principles of building flexible automated production facilities including micro-processing equipment and software for it. It is also necessary to teach the engineer who will work in the next century all this.

[Question] Yuriy Mikhaylovich, what are they doing in this direction in other countries?

[Answer] It is well-known that the technically developed countries have already begun this process -- they have begun to build up national information resources. They are becoming just as fundamental as materials and energy. I must take part in international conferences and exhibitions on machine building. Frequently one hears frank statements from those who wish us evil that they will gain advantages in economic competition since they will soon create flexible technological processes. There is a certain reality to these threats. The question is whether they will create them before us. This now depends on us alone. One thing is obvious: the complexity of the tasks must not frighten those away who are called on to perform them.

[Question] By order of the USSR Ministry of Higher Educational Institutions, your institute was granted the right to train specialists in robot engineering systems and automated design in machine tool building. Why was your institute chosen for these purposes?

[Answer] There are several reasons. The institute has always had a reputation for its high level of personnel potential. And today a strong professor-teacher staff is concentrated here. We were the first ones to build elements of flexible automated production facilities. Maintaining traditions, we are trying to acquire contemporary equipment. Our stock of machine tools ranges from the universal lathes to a type of "processing center," with digital and programed control. We have an appropriate set of contemporary computer equipment at our disposal which may be used not only for complex calculations but also for process control.

Our VUZ could be called scientific-educational. And this is justified. We believe that a good VUZ is one that has a serious scientific foundation. Contrary to the widespread opinion VUZ personnel should be teachers, we believe that they should above all be serious scientists. This is understandable: they will have something to teach young people. It seems that the VUZ which relies only on the old authority of pedagogues cannot perform the tasks dictated by the needs of the society of the future.

[Question] What are the basic principles of reorganization of instruction at the Moscow Machine-Tool and Instrument Institute, based on the program goals of graduating a new type of specialist?

[Answer] Reorganization is accomplished primarily through intensifying the basic training in the first three years of instruction. This is done through introducing new disciplines based on courses in physics and mathematics. Theoretical and mathematical support of systems for automated planning calculations, for example, may be associated with it. In old programs special courses were introduced for each specialty. The work programs of all disciplines include questions and tasks done with the aid of computers and systems of automated planning calculations. In this way, each student, graduate student, and teacher now works a great deal on computers during the instruction process, since for some disciplines up to 1000 hours are assigned by the

syllabi. And such "contact" with computer equipment gives students genuine pleasure. I should think so! It proves to be possible not only to evaluate one's own potential and abilities, but to experience pleasure and joy from elements of creativity which accompany this process.

Quite a lot has been done. But there is still a great deal to do. We need to work on the foundations of the special disciplines. Textbooks and teaching manuals for new courses must be prepared, and in addition old ones for traditional disciplines must be reprinted taking into account the introduction of computers into the educational process.

[Question] The last question. Tell us, Yuriy Mikhaylovich, what difficulties did you have when converting to new syllabi?

[Answer] The basic difficulty was the need to overcome the psychological barrier within the institute. Some of the professors and teachers did not believe in their own abilities or in the possibility of reorganizing their thinking and activity. Others found it impossible to "re-educate" themselves. There were certain difficulties in implementing a uniform system of instruction governed by new syllabi and work programs. Nonetheless, we managed to build such a system which insures training of new types of engineers.

We must always remember that we can win the economic competition with the West depending on how mature the ranks of the engineering profession in the country prove to be with respect to professional, ideological-political, labor, and moral training in the coming century.

Computer Training of Engineers

Moscow SOVETSKAYA ROSSIYA in Russian 17 Dec 83 p 2

[Article by L. Gladysheva under the rubric: "The Engineer of the 21st Century : Robot Teaches Creativity"]

> [Text] Our newspaper began the new feature column "Engineer of the 21st Century" on 11 December. It began with a conversation with professor Yu. M. Solomentsev, the rector of the Moscow Machine-Tool and Instrument Building Institute, which raised problems of training engineers who meet the requirements of the new stage in the scientific-technical revolution. It discussed the role of science in the instruction process and the need to fundamentally reorganize the curricula of the VUZ. Today we continue the column with a story on the experience of the Ivanovo Energy Institute, where new forms and methods of instruction were successfully introduced.

With the rector of the Ivanovo Energy Institute imeni V.I. Lenin Professor Yu. B. Borodulin we are walking along the long corridor of the educational building. Instead of the traditional plates on the doors, there are unusual ones -- "Computer Display Classroom," Computer Graphics Hall," and "Computer Center."

Yuriy Borisovich opens the door, inviting us into the computer display classroom. In the auditorium there are no tables and chairs as the eye is accustomed to; there is also no blackboard along a whole wall streaked with chalk marks of mathematical formulas and diagrams. Before each student is a television screen and a display keyboard -- these are training lessons in exploratory design.

The screen bursts with green letters and an unseen "electronic tutor" asks: "Your last name and class?" The student "writes" the answer on the console of the printer and in a few seconds, after having fixed it in its superior memory, the machine addresses him like an old acquantance: "With which phase are we going to begin the design?"

The student we are standing next to is obviously well-trained and skillfully suggests beginning with the second phase, skipping the first. "Input the nominal parameters," the machine command follows.

The dialog continues. Figures run across the screen and outlines of design flicker -- the display makes it possible to follow the "progression of thoughts" of the most complicated technical calculations, which the computer in the departmental computer center does in a matter of seconds.

And here is the result already: with the aid of the data fed to the computer on the article being designed and its specifications, the "electronic designer" produced the final variant of a design for a new type of transformer, and an automatic "draftsman" will do sketches of its parts -- a plotter is in the next room, the computer graphics hall.

At the present time this work is instructional. The instructional plan formerly allocated several months for course projects. Technical facilities have significantly decreased the time required for their preparation, while the tasks in contrast have become more complicated, having freed students from uncreative preliminary work.

The performance of the course project on transformers which we just observed in reality is part of the educational system of automated design which was developed by scientists of the Ivanovo Energy Institute for Training Broadly Educated Specialists. This system is abbreviated as SAPR.

It is well-known that a person who possesses knowledge and the necessary pedogoical skills himself is able to teach. And what is SAPR able to do, not being a person but a system of interrelated instruments? It turns out a great deal. It can create designs of new machines of machine tools dozens of times faster, perform millions of operations per second, and in doing so not make even one mistake. It can find efficient design solutions, the possibilities of which the designer never even suspected.

The "brain" of the training SAPR is the powerful computers with enormous memory -- storehouses of knowledge generated by man. From the computer display classrooms, and the offices with simulators, and the departmental computer centers, a wide staircase leads to the third floor -- the institute's collective-use computer center.

Supplying computer equipment with the necessary programs is complicated. Suffice it to say that one hour of display work in the conversational mode "costs" thousands of hours of programmer work. It is even more complicated to make computer equipment a tool of the educational process and a means for providing the future engineer with professional knowledge, practical experience, and a "second literacy" -- the skills of a programmer and a developer of automated systems with the ability to use them.

To this end the RSFSR Ministry of Higher and Secondary Specialized Education adopted a scientific-technical program "Systems of Automated Design." The Ivanovo Energy Institute was designated the head VUZ for creating projected educational SAPR's.

At that time, several years ago, the decision of the ministry collegium surprised many people in view of the insignificant capabilities of the peripheral VUZ. But at that time it was precisely the Ivanovo Energy Institute which had distinguished itself by purposeful scientific research on principles of optimal design of energy equpment and development of automated design systems. It was precisely this institute which had begun developing one of the country's first training SAPR's for "Electric Machines," which in the 11th Five-Year Plan were included in the state plan.

If one considers that more than 40 percent of the young specialists graduated in our country are engineering personnel, that the number of creative engineering tasks in basic fields of engineering doubles every 3-4 years and furthermore will increase at even faster rates, that the scientific-technical revolution gave birth not only to new technologies and flexible automated production facilities but also a new technology of technical creativity, it will become clear how important it is to master to perfection the basic principles of building and operating contemporary production facilities.

It has been calculated that training the new type of engineer is 4-5 times more expensive and amounts to 20,000-25,000 rubles per person. Everything is expensive in this: computer equipment, machine time, informational, technical, and methods support of the programs. and technical maintenance. The VUZ-developers received 16 million rubles worth of computer equipment from a cost-accounting scientific association of the RSFSR Ministry of VUZes; nonetheless, many of them, especially Siberian institutes, have a great need for minicomputers and display stations. Both material and nonmaterial expenditures are very great, and to some VUZes they prove to be excessive. What will happen? Who should get the bill for the diploma?

Experience suggests a solution. A number of VUZes today, including the Ivanovo Institutes, are training engineers of high professional qualities for the Ivanovo Association of Heavy Machine-Tool Building imeni 50-Letiya SSSR, the Sverdlovsk Uralelektrotyazhmass enterprise, the Zaporozhye Transformer Plant, and a number of other enterprises with just one stipulation, that the graduates will work directly in their specialties and be developers and users of automated systems. But has the time not come for enterprises snd sectorial ministries who order a highly qualified "expensive" specialist to make their own small contribution to his training? Then, perhaps, it will be fair and expedient.

In connection with this we recall the speech at the All-Union Conference by the general director of the Ivanovo Machine-Tool Building Association V.P. Kabaidze, who, by the way, was today awarded the USSR State Prize for the development and implementation of a flexible automated production facility which makes it possible to build "manufacturing centers" at the level of the best world standard.

"Specialists must be trained with designated purposes for actual enterprises and practical problems, on the condition of receiving basic general training."

Having discussed this problem as one of the priority problems, the head council of SAPR programs recommended that VUZ-developers of SAPR's conclude a comprehensive contract with interested ministries and departments. What do they envision? Target training of engineer - users of automated design systems, retraining of industrial specialists in VUZes, and performance of scientific-research work on building SAPR's for sectors. As is evident, the suggested "services" can dynamically combine VUZ science with the tasks of scientific-technical progress and the demands of the national economy in creating fundamentally new equipment and advanced technology.

Unfortunately, at the present time few have responded to the suggestion. But among them is the Ministry of Electrical Equipment Industry, for whom the Ivanovo Energy Institute has begun to train specialists. Is the difficulty in crossing departmental barriers hindering it? Or is time needed for psychological reorganization?

Most likely, it is both. Organizational questions here are so closely tied to economic and social problems that underestimating some momentarily inhibits the solution of others, and as a result there are large losses in time and capital.

The complex interrelations of man and computers also manifest themselves in a complex way on the most diverse levels.

Let us take, for example, instructional plans and programs for engineering specialists which are in use at the present time. They do not satisfy the requirements for shaping the new type of engineer, while new ones have not been approved although they also exist. It turns out this is not in the jurisdiction of the RSFSR Ministry of VUZes.

"We have taken it as our own personal responsibility," answered Borodulin and somehow guiltily raised his hands. "There was no other way and we had no time to wait."

In all the institute's council assigned about 500 hours for special courses: "Methods and Programs of Optimalization," "Theory of Automated Design," "Methods of Exploratory Design and Adoption of Engineering Decisions,", and others.

They also demanded methods support for the educational SAPR. The burden on teachers has increased considerably: while the staff of professors and

teachers remains as before, individual instruction (instead of the usual group lessons and consultations they have to work with groups of 6-12 students) was added to compiling and programming methodologies. And in the meantime the VUZ- developers only dream and wait and wait for at least a few additional personnel. Especially when the RSFSR minister of higher and secondary specialized education has issued an order on this. But in the meantime the primary moving force is enthusiasm.

Training by Scientific Methods

Moscow SOVETSKAYA ROSSIYA in Russian 28 Dec 83 p 2

[Article by A. Nikitenko, prorector for educational work at the Novocherkassk Polytechnical Institute imeni S. Ordzhonikidze under the rubric "Engineer of the 21st Century : Who Will Take an Unprofitable Topic?"]

[Text] The conversation on the engineer of the 21st Century begun by SOVETSKAYA ROSSIYA in my opinion will arouse animated discussion among employees of higher education. I personally read the first publications under the new rubric with interest. The problem touched upon by the rectors of the Moscow Machine-Tool and Instrument Building Institute and the Ivanovo Energy Institute are close and understandable to every VUZ. It is true that as yet by no means every one has the capability to provide the educational process with contemporary means of instruction and programming as our Moscow and Ivanovo colleagues could.

With all respect to technology, without which an educational institution would surely be impossible today, other issues must also not be forgotten. These are issues whose successful solution will determine the efficiency of our work.

Recent years have been distinguished, in my opinion, by significant changes in the professional orientation of youth. Despite the confident advance of scientific-technical progress, the number of youth who want to acquire an engineering specialty is continually decreasing, competition for technical VUZes is decreasing, and in consequence of this entrants' standards at institutes are comparatively low. The reasons for this are a special discussion. I would like to say, however, that as the situation now stands we employees of higher education who train technical personnel need to find new forms and methods of professional-orientation work with secondary school students, workers, and rural youth, and students in training sections of VUZes. Questions of finding "their own" students have been discussed in the pages of the press many times.

Finding the most efficient ways to build up the educational process is no less important. These are ways which would help increase the academic activism of students, improve socio-political training, and ultimately shape a highly qualified specialist.

Solving the problems enumerated will promote, in addition to everything else, allout development of one of the basic types of activity of VUZ professors and

teachers -- scientific-methods work. The same requirements should be made on the contents of this work as on the contents of scientific-research work being performed in VUZes for the country's economy: strict performance deadlines, compulsory introduction, planning of economic efficiency, and the like. Unfortunately, scientific-methods research today is in Cinderella's position -- its practical return is not very great.

A paradox is at hand: one of the most important sides of the activity of VUZ teachers who are charged with determining the optimal ways and forms of training engineering personnel is clearly being given too little attention. The cause of the situation that has been created is the low popularity of scientific-methods work among teachers in technical VUZes, which is often responsible for weak moral and material incentive. Actually the professor-teacher contingent does conduct scientific research and experimental-design work for the national economy within the confines of economic contracts with industrial enterprises and scientific-research and planning-design organizations. Economic contract relations envision allocating means to acquire equipment and materials; part of the work may be performed by outside organizations. And finally, money is allocated for wages and paid to developers in addition to the basic salary. When people successfully complete and introduce economic contract work, they receive bonuses also, that is, additional material incentive.

Work in a VUZ usually envisions writing and defending dissertations which are the criterion of increasing a teacher's professional training. Dissertations (especially candidate dissertations) are written mainly on the subject of economic contract work which, as a rule, is put into practice and has a planned economic impact.

VUZes conduct scientific-methods research on the subject of the state budget. This work is often poorly supplied with the necessary laboratory facilities and auxiliary personnel, and there is no additional pay. Opportunities for preparing dissertations on methods themes for teachers in technical VUZes are extremely limited (there are difficulties with scientific supervision, graduate work, and defending dissertations in the appropriate councils, and so forth). If one adds to the difficulties listed above the problem of introducing and evaluating efficiency, it will become clear that scientific-methods work in a technical VUZ is not prestigious.

Technical VUZes train specialists for industrial enterprises and organizations. In recent years after the decree by the CPSU Central Committee and the USSR Council of Ministers "On the Further Development of Higher Education and Increasing the Quality of Specialist Training" (1979), a new form of relations of VUZes with ministries, associations, and large plants became increasingly widespread: conclusion of long-term contracts for cooperation in training personnel, performance of scientific-research work, development of the material base of VUZes, and so forth.

Enterprises and organizations are vitally interested in the quality of training of engineering personnel. Consequently, part of the capital which they allocate to a VUZ (for conducting economic contract scientific-research and

experimental design work) should be used for scientific-methods research which improves the educational-indoctrinational process and increases the level of specialist training. There is no doubt that the expenditures mentioned will be repaid. After all instruction will be conducted taking account of the specific nature of the sector for which specialists are being trained.

Practical questions of the structure of economic contract work within the confines of long-term relations of VUZes with industrial enterprises and organizations should be decided by the USSR Ministry of VUZes and Union republics ministries in cooperation with sectorial ministries and associations.

The question of scientific-methods work, in my opinion, is one of the main ones in the problem of improving the educational-indoctrinational process in VUZes. But it is not the only one. Certainly, it seems the task of more practical participation of ministries in the instruction process of students and in developing the material base of VUZes must be solved. Here I am in full agreement with the author of the article "The Robot Teaches Creativity" (SOVETSKAYA ROSSIYA, 17 Dec 83), who asserts that the time has come for "enterprises and electorial ministries who order a highly qualified 'expensive' specialist to make their contribution to his training." Producing engineers for production is a general governmental task, and not only VUZes but also those for whom the higher technical school is working should take part in solving it."

Tomsk Experience in Training

Moscow SOVETSKAYA ROSSIYA in Russian 12 Jan 84 p 2

[Article by A. Chernenko, chief of the department of propaganda and agitation of the Tomsk Obkom of the CPSU, under the rubric "Engineer of the 21st Century : VUZ Cooperation"]

[Text] It is no secret that VUZ graduates frequently lag behind the general progress of the scientific-technical revolution. Not every one of them receives the necessary civil and ideological tempering. And one must keep pace with life and its objective demands and laws. It is well-known that in order to hit a moving target, one must fire with a lead. As practices which are developing in Tomsk show, VUZ cooperation and its pivotal link -- the educational scientific-production complex (UNPK) -- give the possibility of training a student with an aim for the future.

Life has proved: the stronger the interrelations of a scientific-research institute and the VUZ itself, the more qualified the engineer comes out and the higher his social maturity. There has been much talk about the fact that research and academic institutes must turn their attention to the educational and indoctrinational process, but talking is not doing.

And in Tomsk, a path to solving this problem has been found; not the only one, perhaps, but in our opinion a genuine one. This is a structural merging of the educational and scientific subdivisions. Colleges are bound by close relations with scientific-research institutes, and departments are linked to sections and divisions. Managers are becoming unique connecting

links between educational science, and production. It is noteworthy that a corresponding member of the Academy of Sciences and deputy director of an academic institute V.Ye. Panin heads the powder metallurgy educational scientific-production complex and V.Ya. Ushakov, a doctor of technical sciences and director of the high-voltage scientific-research institute heads the Energy Complex. More examples could be given.

It is important to note that the experiment did not require additional resources -- no rates of pay or people were added. They managed economicly with what there was. Now the complexes are turning into independent structural subdivisions monitoring both scientific-indoctrinatioual and research work. This mutually advantageous form of integration makes it possible, on the one hand, to increase the efficiency and quality of the educational process in the VUZ by recruiting experienced specialists, skilled workers, and employees of a scientific-research institute for training students and to more fully utilize the production base for this purpose, and on the other hand, to take advantage of VUZ potential for solving national economic tasks with greater results. For example, leading associates of the university's scientific-research institute of biophysics and biology conduct practical lessons and are presenting 26 special courses (worked out mainly on practical materials of the institute). In TIASUR [expansion unknown] all associates of the scientific-research institute and graduate students are obligated to carry a teaching load of 200 hours per year. At the polytechnical institute department heads manage divisions of head scientific-research institutes, and in the Kibernetika UNPK more than 90 percent of the teachers participate in scientific work, primarily on economic contracts.

We have now come to the most important thing -- the indoctrinational function of the UNPK, which is often forgotten, unfortunately, while scientific and economic considerations are put in first place. But when we were discussing the tasks established by the 26th Congress of the CPSU, the CPSU obkom and VUZ party organizations already saw then what enormous potential there was in cooperation, both in the plan for training personnel and in ideological-moral tempering of youth. The student is not simply becoming acquainted with the newest technology; his thinking is being shaped in practice. He learns to evaluate his role in production and in the collective from a moral standpoint. Involvement in research work helps to indoctrinate youth with a sense of patriotism toward our native science and teaches him to defend his decision and look into the future of engineering and the development of Siberia and the country.

The absolute majority of diploma projects at the Tomsk Polytechnic Institute imeni S.M. Korov are written on practical themes and put into practice. For example, at TIASUR automated systems for management of the economy of Tomsk Oblast and the technological process of pumping oil through the oil pipelines of Central Siberia were developed and put into operation.

Many VUZes have established arrangements where senior students go to a scientific-research institute one day a week. The rationale for a student consists in quickly becoming accustomed to scientific-research work, and this work is on the most contemporary subjects. He works side by side with

his teachers. He is a competent associate in the laboratory and the department. He searches and he thinks. In this situation everything is out in the open and everyone knows exactly what you are worth.

In short, forming scientific habits in a young person proves to be inseparably related to forming a conscious, creative attitude, civil maturity, and pride in our native science and involvement in the transformation of Siberia. In other words, complexes have become a fundamental link with the actual implementation of the demand of the June 1983 Plenum of the CPSU Central Committee for the need to examine the bases of educational process anew and emphasize the organizational side of the indoctrinational process. Furthermore, it seems to us, they make the demand of the Plenum for unity of ideological, organizational, and economic work as applied to higher education a reality. We believe this unity is founded in the very structure of the complex.

At TIASUR non-chartered public organizations are being formed into UNPK's, and at the university unified party organizations which combine communists in scientific-research institutes and colleges are being created.

The complexes have made it possible to look at the activity of scientific associates in a different way also. Not only their performance of economic contract work but also the level of personnel training and their participation in the indoctrinational process are now being evaluated. This approach is also receiving organizational reinforcement. From the next school year at the university, an individual plan of a scientific associate is being introduced in which a definite section is assigned to indoctrinational work with students: curatorship, conversations in dormitories, and so forth.

Nonetheless, is there not a danger here that having been carried away with "special" tasks, scientific workers or teachers will digress from the main thing. A.S. Petrov, the prorector of scientific work of the university, responded to this question in this way:

"Such cooperation enriches both sides. We are stronger together than apart. Thanks to the assistance of scientific-research institute employees, the teaching load of teachers is being reduced and they may use the free time for indoctrinational work and improving skills. And through the assistance of students and department employees, it is as if the scientific-research institute is tripling its staff. In addition, in these conditions the opportunity will arise to significantly increase the quality of training of young specialists. Beginning with the third year, the majority of students are assigned to certain supervisors -- they will lead them up to the defense of their diploma project. For each NII associate there are 1-2 students (NII's perform up to 90 percent of the course work) -- there is an individual approach for you."

What then is in the future? Life itself and the demands of higher education encourage new solutions on the path of cooperation. These objective tendencies are taken into account and monitored by the party obkom. New links in the chain of cooperation are being created by combined efforts. They

help take advantage of the material and cultural valuables of VUZes with best results. An inter-VUZ library has been set up in the city (it combines 6 VUZes and 17 tekhnikums). Last year 95,000 readers used interlibrary resources. An inter-VUZ department of ethics and aesthetics was established on the basis of the university. In the future is the creation of a similar department of general chemistry. A trust of student dining halls and a joint recreation center were organized. Special mention should be made of the inter-VUZ experimental-production complex. Formerly VUZ NII's and laboratories provided materials and equipment for conducting research themselves. Now there is a narrow specialization. Each institute produces or helps others in what it is skilled in. It is understood that assistance is offered for pay. Instruments and equipment are used in a state-minded fashion. Here are the figures: the coefficient of equipment use rose from 0.3 to 0.7 percent, and of computer equipment to 0.9 percent.

The advantage and success of cooperation are apparent, but do any unresolved problems remain today? The experiment is out of diapers and now it turns out that its clothes are not ready yet. Not one complex other than the Kibernitika UNPK has been legally formalized. And consequently, there are many complications. They come down to organizational and legal questions which the rubric "Engineer of the 21st Century" has already stated. But, it seems, these problems are temporary.

Engineer's Role in Production

Kishinev SOVETSKAYA MOLDAVIYA in Russian 22, 25 Jan 84

[22 Jan 84 pp 2-3]

[First part of two-part article by Leonid Kazakov under the rubric "The Specialist: Position and Personality": "The Engineer's Diploma"]

[Text] Leonid Vasil'yevich Kazakov works as the deputy chief of the Special Design Buro of Precision Casting of the Tiraspol Casting Machine Plant imeni S.M. Kirov. For participating in the building of highly efficient equipment for the food industry he was awarded the State Prize of the MSSR.

We are here offering our readers excerpts from his observations on the role of the engineer in contemporary production, and on the ways and methods of increasing the output of engineering labor and the prestige of the profession. The complete text of his observations will be published in the journal KODRY.

The tasks advanced by the November 1982 and December 1983 Plenums of the CPSU Central Committee demand exacting evaluations of what has been done and a deep analysis of both successes and shortcomings. In that the sense L. Kazakov's thoughts are of interest to wide circles of readers. The position of the article on some questions may seem debatable. Nonetheless the problems which the author touches on are urgent and painful ones.

Who else is there? I remember the 1950's: When people met someone with an institute badge on his chest on the street or in society, they unconsciously slackened their pace. . . They very much wanted to examine the shiny little dimond-shaped insignia with their magic figures -- little flags, airplanes, and ships. They attracted the youthful imagination of then secondary school graduates. This was significant, alluring, and prestigious. This was a person with Higher Education.

Now there are many people who wear academic badges; they are as common as watches. And it is not too prestigious; who is there to astonish?

Once I was on a business trip to Czechoslovakia. One of the comrades who had received our delegation turned to me:

"Comrade engineer, allow me to ask a question."
And he introduced himself to us:

"Engineer so-and-so."

Little plates on doors read: "Chief Technologist, engineer." -- and then the family name and first name. Or a signature on official papers, and in front of it the abbreviation -- "eng".

The engineer is respected. That is understandable. But who do we call an engineer today? No, no, I am not talking about a lexical interpretation -- that is understood. I am talking about the position.

There is an amusing game: Who else is there? I will begin: engineer for supplies, engineer for personnel and domestic services, engineer for dispatching, engineer for technical instruction. I ask the reader to continue the list -- who else is there?

Respected comrade suppliers, personnel workers, dispatchers, this is no insinuation. Take the most humble assurance of the author of his deepest esteem for you! But for you I could not have created anything in life and ultimately I would not have written these lines: the laborious problems of supplies, instruction and dispatching would have swallowed me up. I am talking of something else.

Higher education injects streams of information into us; we are taught the most complex problems of mathematics and physics, of dozens of intelligent sciences. It has to be that way. But let us be frank: suppliers and personnel workers do not take mathematical roots, nor derive integers, nor split atoms. They need other knowledge and skills. Why should engineers be needed there? And why do they always have to be called "engineers"? The word "engineer" has one meaning, and only one! And it must not be devalued; everyone loses from that, both engineers and those who are called that simply because a more appropriate name has not been thought of.

Of course, people build equipment. If one traces the introduction of many technical innovations, one can notice the link between their destinies and the destinies of their creators.

Let us take, for example, machine-tools with digital programmed control. Their astounding capabilities lie in the fact primarily that without the direct influence of the machine tool operator on the control organs, they are able to machine articles of any complexity according to a predetermined program.

So machine tools have been created, tested, and reported. Of course, they pour on the words -- on the level . . . higher than the level . . . makes possible . . liberates . . . eliminates. . . insures and so on.

Sometimes introduction has even been started by directive, without taking the specifics of production nor its unpreparedness for such equipment into account.

And "intelligent" machine tools were put where day after day and year after year they machined the same part. All the "intellect" of the innovation went absolutely and completely to waste. But favorable reports would be written: "They were bought, introduced,and we use them." Moreover, they contrived even to scrape up an economic effect from this use, and this, of course, meant bonuses.

Meanwhile plant handymen would "reindoctrinate" the illustrious experts, haul the elegant cabinets packed with electronic equipment away to the warehouse, and then rig up simple devices to make these same machines tools, but now without digital programmed control, some-how finish earning their living for them.

That is how a valuable idea was discredited, and this event is by no means of just local significance.

In pronouncing the word "progress" one wants to lift up his head: logically, progress is higher than the current level. And so building up the stock of machine-tools with digital programmed control is a staircase which leads to progress, while using them for undesignated purposes is movement along the same staircase, but in this case downward.

Let us return, however, to our theme: increasing the number of people with higher education is undoubtedly a path toward progress, but using them as craftsmen is moving down this staircase. As is obvious, the destinies of people are intertwined with the destinies of equipment and frequently they even repeat them. It is not surprising that everything is based on the person. Down a staircase that leads up! None of our progressive views or discussions can justify and even conceal the absurdity of this process. None.

The lion's share of VUZ graduates become foremen. We read one and the same thing in different articles and hear it in speeches. With the contemporary complexity of production a foreman must possess the knowledge of a highly qualified engineer.

Words . . . Words . . . Words . . . Why does a foreman need to know special chapters of higher mathematics? What does he need topology for? And why higher physics? They perform very important and very complicated work, our

production formen, but certainly it is apparent that a foreman needs knowledge in a completely different area: he must master questions of the organization of production, psychology, and pedagogy, if you will. I do not undertake to assert that training such a specialist is cheaper or simpler than a general engineer, but the benefit from such a foreman will be greater. Who needs a bicycle with an attachment for beating eggs? Or a tape recorder with knife sharpener. Objects, like people, should fit their functions.

As far as intelligent machine tools are concerned, the current opinion that today not workers, but engineers should put on overalls, because equipment has become more complicated, is based on militant dilettantism. If we want to have a lot of everything, production needs to be simplified, not by clever philosophizing, but also not in the opposite way. Replacing a worker with an engineer at a machine-tool is a sad case which should quickly be examined from the point of view of absurdity since we can never have enough of them, these very machine-tool operators. Work with a machine-tool must be simplified, and not complicated, and the way upward is to increase reliability and reduce universality.

"The Tsar-Designer." I do not know how it was before, but in our time it is difficult to find a booklet of humorous stories which does not have something or other about us designers. Sometimes through the ignorance of the author, our design buros are called offices, but the point of many humoresques comes down to one thing: "What do they do there?" We already know the classical situations by heart: women, of course, file their nails until lunch -- from left to right, and after lunch -- in the opposite direction, while men discuss the problems of catching fish or sports.

Believe me, this is not true, or not exactly true. Laying it on thick, one always risks losing the genuine hues. But, the humorists are indisputably right about one thing.

The nation's technical VUZes graduate tens of thousands of specialists every year, and they are all snatched up. All kinds of people go "to work" -- intelligent ones and others who are not, suitable ones and ones not quite, energetic ones and so-so ones: rigorous selection has to a certain degree lost its meaning.

In accepting a regular specialist for work, managers of all ranks warn him, "You see, you will have to, how can I say this more precisely, sometimes perform some work which is uncharacteristic of your basic specialization, inasmuch as . . ."

"Pick tomatoes?" the person being hired specifies.

"That too," agrees the chief.

"However," he continues, "since you know everything, let's be frank. You will have to work at a canning plant for about two months out of the year, help the subordinate kolkhoz a little, and if there is a rush in our shop --

you will have to work there. What will you have to do? What they tell you: turn a handle, paint, hammer. I'll tell you more, since you are new here, you'll have to do all this more often than the others. We can't send an experienced specialist to a kolkhoz, certainly."

The employee agrees to everything, at first anyway. They come to an arrangement. The beginner drags himself off to the personnel department, and the employer immediately picks up the phone and dials his colleague's number.

"Congratulate me, old man, I got another tsar-designer."

What kind of a position is this tsar-designer then?

Once a friend asked the writer V.V. Veresayev, who in his youth graduated from a medical faculty, to advise him on some illness he had.

"What are you talking about?" The writer was surprised, "don't you really know that I've been a tsar-doctor for a long time?"

"Why a tsar-doctor?" asked the friend.

"It's very simple," answered Veresayev, "the tsar-bell doesn't ring, the tsar-cannon doesn't fire, and tsar-doctor doesn't treat people."

I grew up in a provincial town where I joined in seasonal work: being without a father after the war was no soft life. In the morning the rasping plant sirens woke us up. Many people were packed into the stuffy little room of the personnel department. We drew out our papers, received directions, and immediately dispersed to the shops, which were rather like steamrooms.

Forgive me for the digression. I am reminded of all this whenever there are orders lying on my desk: send 100 people to the canning plant, the same to the kolkhoz and on and on . . .

Now, it appears, everything is different. At times it seems that food enterprise personnel do not need to work at all. Just turn in a request to someone a little higher up; they will put on pressure, issue an order, and that is the whole job. And qualified engineers of all specialties knock around the shops, at all the enterprises of a city that has long since been "industrial."

About five years ago, I was drawn to the problem of creating highly efficient equipment for agriculture and the wine-making and fruit-processing industries. Incidentally, this was in addition to my main work, as they say, on the side. But the main work was contemporary highly-complicated equipment both for domestic industry and for the fraternal countries as well as for export to capitalist countries. The world-wide scope of this equipment required us to work without respite: to be behind is simplest of all; to catch up is extremely difficult.

Nonetheless, the people who were joined in creative brigades were roused by the appeals and novelty of the problems (which were unusual for their primary occupation) and, as they say, really got going. We built a whole range of mechanisms, devices, and automatic production lines, among them an electric apparatus which would sort out green tomatoes without human participation. Imagine, it is able to sort out hundreds of pieces of fruit in a second.

It was delivered, documents were signed, and it was recorded. Congratulations, handshakes, and applause. I dropped by the shop at the very height of the season. The instruments were not even plugged in.

"Why not?" I asked in surprise.

"There is no need," they answered, "no big shots are coming."

I am not authorized to give advice; I have other concerns. But if some one of those who with a flourish of the pen convert a mass of qualified people to the most unskilled work would find time, even once a week, to visit his "assistant," (but it must be by surprise, like a real Gogolian inspector-general) he would begin to interpret the crocodile tears of the supplicants for help in a different way.

Respected reader, tsar-designer is also a profession. When you come to us for a job, we will convince you too that creating new equipment is possible during the intervals between vegetable seasons. It is unprofitable to keep them on staff, certainly, but what is to be done?

Were this phenomenon sporadic, there would be no problem. But because it has become systematic, well then, losses of work time from using specialists for other purposes have no effect at all, either on the number of projects or on their quality. So let us once sum up the losses and reduce the personnel of the design buro by this number. We will no longer hire tsar-designers or tsar-technicians. Isn't that logical, after all?

Standardication... Those who hear monotony and dryness in this word cannot imagine that we suffer most of all from confusion precisely where the impact of standardization itself has been inadequately felt. But this is a whole science. In searching for solutions to tangled labyrinths people standardize everything: qualitative indicators of articles, their classification, and even production relations. It would be impossible to work without doing this. And here is what is revealing: the ability to think creatively without firm knowledge of the legitimate norms of engineering may turn out to be the same kind of useless accessory for a designer as, say, superior skates for figure skating for a person who has never stood on the ice. The general educational training of an engineer on issues of standardication is limited to the most general conditions. Future cooks are taught as much about petroleum. And this is how technical literacy is taught!

But in order to represent any technical idea on paper, a great deal must be known. The documentation for a common meat grinder, including numerous documents, agreements, sketches of equipment and so on is probably enough paper to contain the monthly program of the meat grinders themselves and there would still be paper left for answering complaints. And the creative

process for building the meatgrinder will be fitted in on one page of drafting paper the size of half a sheet of newspaper. And this is the assembly drawing, that is, the product of a creative engineer. And what is the rest then? The rest is simply work. Necessary, inevitable, important, but work. The more complex the article, the smaller the part of technical documentation which relates to the category of creativity. In this way the split personality of the designer arises: management demands original technical solutions and, of course, quality documentation. The standardizers as guardians of technical law are obliged to observe the canons strictly. Production experts "bring the designer to earth" with production capabilities. In other words, some call on them to take off in free flight, while others demand that they descend to the sinful earth. As a result a designer spends a good three-fourths of his creative life filling out forms for what he managed to create in the other fourth.

And how does this go for others? In musical art, for example, there are people who spend their time orchestrating exclusively, and this is by no means considered a shameful profession. Not having composing talent, these people use their musical literacy to do that part of the work which requires only irreproachable knowlege of the laws of composition.

Let us imagine a fundamentally different division of designer labor: a skilled designer who is able to think creatively works out the technical solutions of the article being created and the general arrangement specifying with the necessary degree of detail the most important assemblies, those that determine the essense of the whole article.

The solution is accepted. At a brief meeting with the leading specialists he defends it, amazing his colleagues with the content of the design jobs and their performance times. And then the process moves on. They charge designer's assistants (or whatever they are called there) with making up the papers for what has been decided. Filling out these forms means creating technical documentation which is literate in all senses, or in other words, "orchestrating" the assembly drawings.

Once I expressed these thoughts to a certain important manager and he almost challenged me to fight. And he explained: by forcing designers only to bring someone's idea to the point of production, we lose people little by little, since we humiliate them. And I said to him: "Do you agree to be operated on by a very good doctor from a polyclinic, a person who is devoted to you and a fine diagnostician, but not a practicing surgeon?" "No," he answered, "but that's something else." "It may be something else," I said, "but realize after all that a standardizer-form filler also has to know a great deal; but he is, after all, the one who knows the laws. It seems to me personally that standardization is an edifice built completely out of corner-stones."

He heard me out. He smiled. He said:

"Save up the aphorisms for your offspring. Maybe they'll appreciate it."

He had not understood anything.

[Conclusion of two-part article by L. Kazakov under the rubric: "The Specialist: Position and Personality : The Engineer's Diploma"]

[25 Jan 84 pp 2-3]

[Text] Written and Unwritten Laws

"It is terrible to live without choice. It is awful. More awful than anything," wrote R. Rozhdestvenskiy. Right you are, esteemed Robert Ivanovich . . . On behalf of my clleagues and myself personally, allow me to thank you for managing in so concise a form to express a feeling which we designers experience when our inquiries at appropriate administrative levels about the possibilities of using some element or other in new elaborations are rejected inasmuch as . . .

No, I did not send such a letter. And I did not write it. The poet has enough concerns without us. Let him write verses -- he knows how to do that! And we will try to manage things ourselves.

It would seem the simplest thing in the world. Read information sheets regularly, order new things, and apply them. Of course, consult with the developers, seek advice if needed, and fill out the authorization . . . Stop! "Fill out an authorization" -- how does this take place?

There is a state standard which precisely defines the precedure for coordinating the use of assembly components, let us say, of push buttons, switches, bulbs, and all sorts of other things which one does not produce oneself. On its title page is a menacing warning: "Non-observance of the standard is prosecuted by law."

Let us note, that this warning differs radically from what we read on the package of tobacco products -- "Smoking is harmful to your health." After all, no one has as yet been put in prison for flagrantly ignoring this solicitous warning from the Ministry of Health. The matter, as they say, is personal -- smoke as you please. But do not joke with a state standard. Everyone knows that and tries not to. But not everyone manages.

So, we open the standard and we do what it orders. We fill out the forms, sign them, authenticate all of them with impressive stamps, and send them to the proper address. Now we wait and hope. Why not? After all, we have done everything as instructed. We do not in the least intend, let us say, to use transistors as additives for concrete mixtures or electric lights for decorating New Year's trees. In our plans all these elements will work in their usual conditions; in short, everything as it should.

Fundamentally new articles need fundamentally new elements. This is an axiom. In our work especially; electronics is a restless child. It does not like to rest in one place for a minute. And here we are waiting. We are heavy-hearted, and not for nothing. All the deadlines stipulated in the standard have

run out and no response. We remind them politely. Finally, it comes -- a refusal! Our palms moist with anxiety, we look in the "belly" of the envelope for the list of proposed replacements that the standard specifications itself stipulates. But there is nothing there except the word "no" itself, short and pitiless like the blow of an axe.

"Excuse me," we are indignant, "but after all the state standard guarantees us an option and those who refused us are obliged to offer it. There is no option."

I call the man in charge of the article.

"Change the plan immediately. We got a refusal."

"Can I have a week?" he asks.

"Why drag it out? Change the plan.

"Give me a week," he insists.

He has thought of something. He asks permission to go on a business trip.

"I'll be able to convince them."

I doubt it, but there is nothing else to do.

Dear experienced reader, must I explain to you that among the multitude of measures of persuasion, there are some which no one can resist. It is not proper to talk about them; it is proper to take advantage of them. On this occasion the man convinced me, went there, and convinced them. And he has accomplished this more than once. Unprofitable, of course, but the job was done.

Do you want to see the world? Not on television, of course, but directly, personally, as they say. Become a designer. I do not guarantee that you will always be welcomed like a relative; it can happen that there are no rooms at the hotel and it is difficult to get tickets, but after all everywhere there are people -- work it out! But on the other hand, there are so many impressions. And acquaintances, and connections! Become a designer; you will not regret it.

Incidentally, about connections. Some of these elements you need may be acquired through direct connections. This is when you receive an official refusal, but you, as it is now usual to say, get it anyway. It is as if you stretched your arm up and got it from the shelf. Honestly speaking, methods of obtaining something in this way frequently are worthy of another genre, the protocol for example.

To tell the truth, things are not as simple as they seem at first glance. Everyone needs everything and a great deal of it. And no one will bring us anything. I am speaking of something else. We designers understand well

that someone should produce exactly as many articles in higher demand as there is demand for them, but this in itself is not simple. But then the state standard, the ignoring of which is prosecuted by law, should orient us to the capabilities of industry.

The standard is a written law; what are unwritten ones needed for?
Thirty-Eight Parrots

Of all the wise principles upon which the indoctrination of our citizens is built, the fairest and most significant one, it seems to me, is one of our main principles: "From each according to his abilities, to each according to his labor."

To each according to his labor! This means, above all, that any human labor should be its own measure: precise, fair, and the only one. But how difficult it is to correctly establish a norm of human labor in accordance with which the blessings granted to man will be distributed. Come what may, when a product of labor, as they say, is there you can count it, measure it, and pay for it. But how do you set norms for creativity?

The work of a designer is not completely creative. We have already talked about this. In the very last part of the designer's work when the process of filling out technical documentation is taking place, problems of norm-setting are more or less solved.

However, there have already been many attempts to create uniform norms of time for doing planning work, but they have a harder time becoming established than a poorly fitted tooth in your mouth. The reasons for this are the same emotional evaluations which occur in poetry: a bad line, a good line . . .

Graduation of designer work according to degree of complexity is common to all norms. Having adopted a unit, it may be established, for example, that the complexity of a certain assembly or mechanism reduced to this unit is a certain number. Of what? Units, of course. Which units? Those very ones, to which it was reduced.

It is no easier with every passing hour.

Take a meatgrinder as an example. Let us suppose, that according to the technical complexity of articles, it belongs to the third category. Let us say, for example, that it takes one person 10 days or, as we usually say, 10 man-hours to build a meat-grinder. Let us also take two other articles, for example, a vacuum cleaner and a nutcracker. The vacuum cleaner, let us assume, is twice as complicated as the meatgrinder while the nutcracker is twice as simple. It follows from this that to develop a vacuum cleaner takes 30 man-hours and a nutcracker only three.

Everything, it seems is simple. But this is not the case at all.

All this proportionality is justified when the genuine correlation of the complexities of the articles is obvious, but this is by no means always

clear even when there are no parallel and counter streams of work in their creation (but it does not happen that way) and when there are no unforeseen losses of work time for various types of coordination (this is practically excluded), and much more.

And then, what is a meatgrinder in comparision, let us say, with an airplane? And what is a nutcracker in comparision with a motor vehicle or a typewriter key? After all, there are millions of articles. And the degree of readiness for their creation, i.e., the accrued work time or the reserve, is also far from equal.

Enumerating or even keeping track of all this in norms is about as easy as counting the stars. But everything must be build: the typewriter key, the nutcracker, and the motor vehicle. And all this has to be not only thought over, drawn,and documented, but also watched in production all its life. Some materials are withdrawn from production -- what should they be replaced with? An instrument has worn out -- what will the sizes of parts be? Something is not moving, it is leaking somewhere -- drag a designer over there, let him figure it out.

Do you want to be needed by everyone thousands of times a day? Become a designer. Without them, nothing can happen . . .

Designers still have to teach, and study, and do everything we have already talked about: help someone, rescue someone, go somewhere, and draw, draw, draw . . .

The Zhiguli 2101 is an exceptional machine, but a second and a third model, an eighth, a ninth, are already on the drawing boards -- how many more are needed? When will the end be? Never! We do not like to stop at something, even when it is very good. And we are doing the right thing.

A telephone apparatus with a dial is out of date, let's have one with push buttons. You already have one with push buttons? Out of date! Let's have one with a memory, with a loudspeaker, with a television . . .

Do not stop, do not rest content -- such is man. And that is fine! He wants and has the right to live comfortably and nicely, where it is not expensive and there are no shortages.

"What do they do there, those designers? What kind of television is this? To make it louder, you have to get up to make it clearer -- you go over to it. I do not want to get up and go over to it, I want remote control, not rising from my chair, in my mind."

And it is right that you want it, comrade, and not only in your mind: for this price the television could itself guess that, that you are tired of this program.

We do not take offense at you, because after work we are the public like you. And we also want all of these things.

But someone has to master all these things.

In the set work routine of the design buro, functions are determined in accordance with the staff schedule: so much for the foremen, so much for his subordinates, so much for everyone else. Moreover, the volumes of planning work are also determined. Even if approximate, with questionable assumptions, still they are determined.

All right, for example, 20 people work in the buro: two foremen, ten subordinates, and eight technicians. Let us suppose the wage fund of the buro amounts to 26,000 rubles a year. Not going into the details of economic calculations, let us agree that the volume of work which our buro is to perform will correspond to the wages which the developers should receive, i.e., 36,000 rubles. Let us also suppose that two employees took vacations at their own expense to take care of their children while one was fired after having worked for a part of the fiscal year. Here we add on the savings in the wage fund owing to the short vacations with the administration's permission: for family circumstances, preparing for exams and others. Let us suppose that as a result of all this, the design buro did not use, let us say, 3,500 rubles. Will an amount of work worth this sum be taken away from the buro? No, of course not: the plan ought to be fulfilled in any case. Taking on the part of "temporary" workers is to one's disvadvantage. But after all the work is nevertheless done. In full, for the whole 36,000 rubles of the wage fund. Well then, the collective earned its 36,000 for the year. Someone substituted for someone else and took his functions on himself. But the important thing is that the work is done.

Would it then not be logical to pay the wages of those missing to those who actually performed their work? Not all of it, just a part of it, but pay them?

Otherwise it is reasonable to pose the question whether the ratio of the volume of work done, and the amount of wages which was to be paid for all the work, was selected correctly. If the work itself can be performed at the price of fewer expenditures, then why plan for excess?

I repeat once again: to estimate the value of projected work with adequate precision is very difficult. Mistakes are inevitable. But in light of all this, once the capital for the subject is determined, should it not be paid to those who performed the work well and on schedule?

What has been said here about the so-called combining of occupations is not a revelation: regulations have been in existence for a long time which permit supplemental payment for additional work, paid from savings in the wage fund; but I have not run across a planning organization where this is done. This is a shame; everyone could benefit.

In the first place supplements to wages would be of a temporary nature, which would not create the "habit" which inevitably accompanies any wage increase. In the second place, there would be no problems with searching for solutions to difficult situations when the number of workers is reduced for objective

reasons. Thirdly, trying to be recruited for substitute work, every employee would be more concerned with the quality of his own work, in order not to seem unable to"pull his own weight" and that of a comrade who is temporarily absent.

And, finally, the manager of a planning buro would receive those very "levers" which might make it possible to influence the quantity and quality of work within reasonable limits.

As far as possible abuses are concerned, the misgivings on this account do not seem to me to be substantiated, inasmuch as this whole process is no more complicated to monitor that what is being done today. And this does not contradict the principle of "to each -- according to his labor" to the least degree.

But the system of bonus incentives which exists today, to the general misfortune of all designers, does not stand up to any criticism; it absorbs into itself all the worst of both egalitarianism and indifference, and the Lord knows what else, but certainly, the worst that there is.

Economists fight for extensive introduction of the contract brigade method. Most likely this method could become the property of the creators of new equipment in just this way.

One way or another, the system of setting norms for planning-design work which exists today should be reviewed immediately. Because right now it . . . Do you remember a fascinating animated cartoon in which a likeable boa constrictor wanted very much to know its exact length? Each of his friends proposed his own measure but the one from his feathered comrade proved to be best of all: the length of the boa constrictor was 38 parrots.

It is exactly the same with us.

Everything we have talked about in this narrative is our work-a-day world. Each day of the work-week is marked by research and accomplishments; forgive me for the elation of these words!

I love my work very much. I hope this does not sound immodest, but seeing the concrete embodiment of your thoughts in stone, metal, and wood -- whatever you wish -- that is happiness!

Have I personally managed to accomplish a great deal in 20 years? Unfortunately, to count the good concepts in designs created by me, the fingers of one hand would suffice. Each one of them is all the more dear to me. Stacks of author's certificates -- that is only a small part of my creative life, but even all of them by no means represent the same value for the work. And we are not the only ones who flatter ourselves with the brilliance of showy regalia. The life of a designer is above all hard work. And still, esteemed reader, I invite you to tread this path.

There are rules for choosing solutions, but there are no rules for selecting these rules -- this is about us designers. "We went today to create vengeance in the utter fever of our humdrum life." This is also about us. We know the value of the exclamation "Eureka!" and we know the bitterness of failures. All these negative occurrences which you have read about here are no more than annoying rubbish beneath our feet. It makes it difficult to walk, but it cannot stop us.

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18 MAY 1984